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PART I.

1912

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OF THE

BUREAU OF MINES, 1912,

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VOL. XXI., PART I.

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No. 21a. Porcupine Gold Area, third edition, Districts of Sudbury and Nipissing, Ontario, by A. G. Burrows, Geologist, and W. R. Rogers, Topographer. Geologically colored; scale, 1 mile to 1 inch.

No. 21b. Swastika Gold Area, District of Nipissing, Ontario, geologically colored, to accompany Report of E. L. Bruce; scale, 40 chains to 1 inch.

No. 21c. Munro-Guibord Gold Area, District of Nipissing, Ontario, to accompany Report of A. G. Burrows. Geologically colored; scale, 1 mile to 1 inch.

No. 21d. West Shining Tree Area, District of Sudbury, showing route from Ruel Station, C.N.O. Ry., to accompany Report of R. B. Stewart. Scale, 2 miles to 1 inch.

No. 21e. Cripple Creek Area, embracing the Townships of Whitesides, Carscallen, Keefer and Denton, by W. R. Rogers and E. L. Bruce. Geologically colored; scale, 1 mile to 1 inch.

LETTER OF TRANSMISSION

To His Honour Sir John Morison Gibson, Etc., Etc., Etc.,
Lieutenant-Governor of the Province of Ontario.

Sir,—I have the honour to transmit herewith, for presentation to the Legislative Assembly of the Province of Ontario, the Twenty-first Annual Report of the Bureau of Mines.

I have the honour to be, Sir,

Your obedient servant,

W. H. Hearst,
Minister of Lands, Forests and Mines.

Department of Lands, Forests and Mines.
Toronto, 18th March, 1912.

INTRODUCTORY LETTER

To The Honourable William Howard Hearst,
Minister of Lands, Forests and Mines.

Sir,—I beg to hand you herewith, to be presented to His Honour the Lieutenant-Governor in Council, the Twenty-first Annual Report of the Bureau of Mines, in two Parts.

Part I reviews the condition of the mining industry of Ontario for the calendar year 1911, and in a series of statistical tables shows the growth and development of its various branches. The aggregate output of minerals and mineral products is shown to have been larger in value than in any previous year, exceeding that of 1910, previously the largest, by $2,662,902. Several years ago Ontario assumed the first place among the confederated Provinces in the value of metallic products, and this position is still easily maintained. The principal metals of production are silver, nickel, pig iron and copper. Out of every seven ounces of silver raised from the mines of the world, one comes from Cobalt. Sixty-five or seventy per cent. of the world's consumption of nickel is derived from the mattes of Sudbury. In minor products, cobalt oxide made from the Cobalt ores now practically supplies the whole of the European and American trade. Arsenic from the same source; mica from Eastern Ontario (and Quebec), and corundum from Hastings and Renfrew counties, contribute largely to the trade in these respective substances on this continent. There are indications that gold will also soon move up from a subordinate position on the list of Ontario's metals to a more important one. In other departments of the industry the changes going on are noted in the Report. Petroleum continues to decline in yield, and natural gas to increase. The production of iron pyrites is greater than formerly, and the potential output is large. The same is true of feldspar, and the marbles of the Bancroft area are by their beauty and variety of colour, and the large sizes which can be obtained from the quarries, rapidly winning favour in decorative construction work. The revenue obtained by the Government from mining sources is analyzed in some detail, and other departments of administrative work are dealt with.

Mining Accidents form the subject of a report by Mr. E. T. Corkill, Chief Inspector of Mines, who also describes the working mines and quarries under the title "Mines of Ontario."

According as new discoveries are made and new mineral fields opened up, public interest is concentrated now upon one mineral, now upon another. At one time it is nickel, at another iron, and again it is silver. The finds of gold at Porcupine have called attention to this metal and to other portions of the Province where it is known to exist. The present Report deals with a number of these districts.

Mr. Arthur L. Parsons, who reported in the Twentieth Annual volume on the Gold Fields of Lake of the Woods, Dryden and Manitou, was in the same field during the summer of 1911, and makes a second report under the above title.

The geology and mineralogy of the Porcupine Gold Area were described by Mr. A. G. Burrows in Part II of the Twentieth Report (1911). This area was again visited by Mr. Burrows last year, and his report is republished in the present volume, considerably enlarged, and accompanied by a more extended and detailed geological map.

Mr. W. R. Rogers describes at greater length the Water Powers in the Porcupine Area which were mentioned more briefly in last year's volume. The Swastika Gold Area, and the Cripple Creek Gold Area, are briefly described by Mr. E. L. Bruce and Mr. W. R. Rogers respectively; Mr. R. B. Stewart makes a preliminary report upon the West Shining Tree Gold District, and a few notes are given by Mr. Percy E. Hopkins on the Gold finds in McArthur Township. The volume concludes with Notes on the Geology of the Detroit River Area by Rev. Thos. Nattress of Amherstburg.

Part II brings together all available information, derived mainly from the Annual Reports of the Geological Survey of Canada, on the District of Patricia, newly added to the Province of Ontario. The resources of this District are dealt with under appropriate headings, and there is an Introduction and Summary of Contents by Professor Willet G. Miller, Provincial Geologist, who compiled the contents of this Part. A map of the District of Patricia accompanies the Report.

I have the honour to be, Sir,
Your obedient servant,
Thos. W. Gibson,
Deputy Minister of Mines.

Department of Lands, Forests and Mines.
Toronto, 18th March, 1912.

REPORT OF
THE BUREAU OF MINES
1912

VOL. XXI PART I

STATISTICAL REVIEW

By Thos. W. Gibson, Deputy Minister of Mines

The Mining Act of Ontario (section 170) requires the owners or operators of all mines and mineral works in the Province to make returns to the Bureau of Mines, showing the quantity and value of the minerals produced during the year, and to give such particulars, as to number of employees, wages paid, etc., as are necessary for statistical purposes. Returns made in pursuance of this provision show that the mineral production for the year 1911 had a value of $41,976,797, which is an increase, as compared with the previous year, of 6.7 per cent. During the six years, ending with 1911, the annual production increased by 87 per cent.

Much the larger proportion of the output is now of metallic substances; last year, 70 per cent. of the value was of this character, 30 per cent. being non-metallic. Taken as a whole, the metallic list shows a small increase over 1910, about 3 per cent. There was a falling off in nickel of $341,487, in copper of $92,985, in iron ore of $67,791, and in gold of $25,861; but these decreases were more than offset by an enlarged production of silver by $472,573, and of pig iron of $740,896.

In the non-metallic products, petroleum declined by $14,580, lime by $72,191, mica by $42,236, calcium carbide by $99,886, and corundum by $24,836. On the other hand, natural gas increased in value by $695,523, iron pyrites by $20,104, gypsum by $14,710, Portland cement by $496,299, common brick by $427,684, and stone by $131,501. With the exception of lime, all construction materials were produced in larger quantity and greater value. The same is true with regard to all clay products used for other purposes, save pottery. Seven substances contributed 88.1 per cent. of the total value, as follows: Silver, 38 per cent.; pig iron, 18 per cent.; nickel 8.7 per cent.; Portland cement, 8.6 per cent.; common brick, 6.6 per cent.; natural gas, 5.2 per cent.; and copper, 3 per cent. The remaining 11.9 per cent. was divided as follows: Other metals, 1.6 per cent., clay products (other than common brick) 3.5 per cent., miscellaneous non-metallic materials 6.8 per cent.

While the past year was not one of sensational discoveries or the opening up of new and important mineral fields, it was one of steady progress and active production. The silver mines of Cobalt touched high-water mark, the nickel-copper deposits of Sudbury were but little behind in their output that of 1910 (the largest yet), the natural gas fields yielded nearly 50 per cent. more than last year, the blast-furnaces turned out more pig-iron, the brick and tile yards more brick and tile, the quarries more stone, and the long list of lesser industries concerned in the production of other materials were, in general, more busily employed. At least one promising mineral area has been revealed by the untiring prospector—that at West Shining Tree Lake—where free gold has been found in some large bodies of quartz. It should also be mentioned that two metals, one of them hitherto quite unknown in Ontario, and the other practically so, were added to the list of minerals. For the first time in the Province mercury was recognized, being found at the Nipissing mine associated with some of the richer silver ores. The other was tungsten, which, in the form of scheelite, was identified by Mr. A. G. Burrows, of the Bureau of Mines geological staff, in vein matter at the Jupiter gold mine, Porcupine. The only previous mention of this metal in the Province was by the late Prof. Chapman, who detected wolframite in a boulder on Lake Couchiching many years ago.

The following table gives the mineral production for the year, and, in addition, the number of employees and the amount of wages paid in the several branches of the industry.

Table I.—Mineral Production of Ontario, 1911

Product.		Quantity.	Value.	Employees.	Wages.
Metallic:			$		$
Gold	ounces	2,185	42,637	597	442,519
Silver	"	31,507,880	15,953,895	3.555	2,977,721
Cobalt	tons	853	170,890	(a)	(a)
Nickel	"	17,441	3,664,474	2,439	1,830,526
Copper	"	8,966	1,281,118		
Iron ore	"	175,631	445,930	685	348,062
Pig iron	"	526,610	7 716,314	3,633	2,927,573
			29,275,258	10,909	8,526,401
Less Ontario iron ore (67,631 tons) smelted into pig iron		....	172,391		
Non-metallic:			29,102,867		
Arsenic	tons	3,806	71,609	(a)	(a)
Brick, common	No.	354,546,000	2,801,971	3,149	1,320,677
Tile, drain	"	21,630,000	349,545		
Brick, paving	"	4,522,400	86,685	505	271,343
" pressed	"	52,763,914	564,630		
Building and crushed stone		....	892,627	1,152	516,643
Calcium carbide	tons	1,383	84,437	50	18 497
Cement, Portland	bbl.	3.010,849	3,640,642	1,471	898,256
Corundum	Tons	1,471	147,158	199	124,491
Feldspar	"	17,697	51,610	76	26,580
Fluorspar	"	30	200	....	....
Graphite, refined	"	894	36,492	55	33,774
Gypsum	"	20.335	32,535	100	10.000
Iron pyrites	"	43,629	118,457	172	114,655
Lime	bush.	2,469,773	402,340	343	148,078
Mica	tons	322	43.058	60	24,782
Natural gas		....	2,186,762	287	183,663
Peat	tons	1,180	2,830	21	2,964
Petroleum	Imp. gal.	10.102,081	353,573	511(b)	314,851(b)
Phosphate of lime	tons	20	240	1	262
Pottery		....	50,500	38	16,752
Quartz	tons	56,723	64,405	110	40,459
Salt	"	88.689	430,835	216	121,477
Sewer pipe		....	410,064	250	126,099
Talc, ground	tons	5,404	47,725	38	17,530
			12,873.930	8,804	4,331,833
Add metallic production		....	29,102,867	10.909	8,526,401
Total production		....	41,976,797	19,713	12,858,234

(a) Included in statistics for silver. (b) Refining works only.

The fluctuations of production among the several items, as compared with 1910, are shown in the following table:—

Table II.——Comparative Value Mineral Production, 1910 and 1911

Product.	1910.	1911.	Change. (I) Increase. (D) Decrease.	
Metallic:	$	$		$
Gold	68,498	42,637	D	25.861
Silver	15,481,322	15.953,895	I	472,573
Cobalt	54,699	170.890	I	116.191
Nickel	4,005,961	3,664,174	D	341,487
Copper	1.374,103	1,281,118	D	92,985
Iron ore	513,721	415,930	D	67,791
Pig iron	6,975.418	7,716,314	I	740,896
Zinc ore	5,760	....	D	5,760
Non-metallic:				
Actinolite	320	....	D	320
Arsenic	70,709	74,609	I	3,900
Brick, common	2,374,287	2,801,971	I	427,684
" paving	70,648	86,685	I	16,037
" pressed	458,596	564,630	I	106,034
Building and crushed stone	761,126	892,627	I	131,501
Calcium carbide	184,323	84,437	I	99.886
Cement, Portland	3,144,343	3,640,642	I	496.299
Corundum	171,994	147.158	D	24,836
Feldspar	47.518	51,610	I	4,092
Fluorspar	15	200	I	185
Graphite	55,637	36,492	D	19,145
Gypsum	17,825	32,535	I	14,710
Iron pyrites	98,353	118,457	I	20,104
Lime	474,531	402,340	D	72.191
Mica	85,294	43,058	D	42,236
Natural gas	1,491,239	2,186.762	I	695,523
Peat	1,284	2.830	I	1,546
Petroleum	368.153	353,573	D	14,580
Phosphate of lime	....	240	I	240
Pottery	51,485	50,500	D	985
Quartz	87,424	64,405	D	23,019
Salt	414,978	430,835	I	15,857
Sewer pipe	357,087	410,064	I	52,977
Talc	46,592	47,725	I	1,133

The figures presented in Table III., which follows, reflect the advance which the mining industry of the Province has been making during the past five years, both in the gross and in its various branches. It will be seen that the output of metals has increased by 100 per cent., and of the total production by about 68 per cent. Silver, nickel and pig iron have risen rapidly; so have natural gas and Portland cement. Copper, clay products generally, stone, arsenic, iron pyrites and talc, also show substantial progress. Gold and iron ore, judging from the table only, exhibit a tendency to diminish rather than increase, but there are grounds for believing that this tendency is not likely to persist. Lime and petroleum are declining, and apparently quartz also. A few substances, such as mica, pottery and salt vary little from year to year. One or two others, such as corundum and carbide of calcium, show sudden and sharp fluctuations. On the whole, however, the record is one of steady and satisfactory growth. Many of the products, it may be added, exist in large quantity, and are capable of responding readily to any increase in demand.

Table III.—Mineral Production, 1907 to 1911.

Product.	1907.	1908.	1909.	1910.	1911.
Metallic:	$	$	$	$	$
Gold	66,399	60,337	32,445	68,498	42,637
Silver	6,157,871	9,136,830	12,464,722	15,481,322	15,953,895
Cobalt	92,751	111,118	91,965	54,699	170.890
Copper	1,045,511	1,071,140	1.127,015	1,374,103	1,281.118
Nickel	2.271,616	1,866,059	2,790,798	4,005,961	3,661.474
Iron ore	482,532	574,839	645,622	513,721	415,930
Pig iron	4,716,857	4,390,839	6,301,528	6,975,418	7.716,314
Zinc ore	....	....	8,950	5,760	....
	14,833,537	17,211,162	23,466,045	28,479,482	29,285,258
Less value Ontario iron ore smelted into pig iron	282,702	456,176	537,549	317,804	172,391
Net metallic production	14,550,835	16,754,986	22,928,496	28,161,678	29,102,867

Table III.—Continued

Product.	1907.	1908.	1909.	1910.	1911.
Non-metallic:	$	$	$	$	$
Actinolite	....	....	....	320	....
Arsenic	40,104	40,373	61,039	70,709	74,609
Brick, common	2,109,978	1,575,875	1,916,147	2,374,287	2,801,971
" paving	73,270	61,554	73,700	70,648	86,685
" pressed	648,683	485,819	490,571	458,596	564,630
Building and crushed stone	675,000	530,041	660,000	761,126	892,627
Carbide of calcium	173,763	147,150	151,676	184,323	84,437
Cement, natural rock	5,097	....	....	....	....
" Portland	2,777,478	2,417,769	2,897,348	3,144,343	3,640,642
Corundum	242,608	11,437	140,817	171,994	147,158
Feldspar	30,375	20,300	36,204	47,518	51,610
Fluorspar	....	....	....	15	200
Graphite	20,000	1,600	37,624	55,637	36,492
Gypsum	19,652	20,778	23,604	17,825	32,535
Iron pyrites	51,842	69,980	78,170	98,353	118,457
Lime	418,700	448,596	470,858	474,531	402,340
Mica	82,929	73,586	73,124	85,294	43,058
Natural gas	746,499	988,616	1,188,179	1,491,239	2,186,762
Peat fuel	1,040	900	240	1,284	2,830
Petroleum (crude)	1,049,631	703,773	559,478	368,153	353,573
Phosphate of lime	....	7,048	1,904	....	240
Pottery	54,585	50,310	43,214	51,485	50,500
Quartz	124,148	52,830	75,329	87,424	64,405
Salt	432,936	488,330	389,573	414,978	430 835
Sewer pipe	435,088	344,260	311,830	357,087	410,064
Sodalite	....	....	....	....	....
Talc	5,010	3,048	8,700	46,592	47,725
Tile, drain	250,122	338,658	363,550	318,456	349,545
Total non-metallic production	10,468,538	8,882,631	10,052,879	11,152,217	12,873,930
Add metallic production	14,550,835	16,754,986	22,928,496	28,161,678	29,102,867
Total production	25,019,373	25,637,617	32,981,375	39,313,895	41,976,797

The history of mining in this Province begins with the days of the early settlers, who made shift to smelt the bog iron ores and outcroppings of magnetite into stoves and potash kettles, and an interesting narrative could be written showing how the industry has developed step by step as one useful mineral or rich mining field after another has been discovered, often by accident, sometimes after careful and patient search. The records of actual mining operations carried on before systematic collection of statistics of production was begun, are not now full or complete enough to afford exact information as to results. In a previous volume[1] the best available figures were presented, showing the output of metals and metallic ores since mining began in Ontario, and in Table IV., given below, these figures are brought down to the end of 1911.

Table IV.—Total Production of Metals in Ontario

Product.	Quantity.	Value.
		$
Gold oz.	165.521	2,620,627
Silver "	130,371,791	79,504,371
Platinum and Palladium "	3,364	62,784
Cobalt tons	6,068	756,360
Nickel "	136.114	36,276,303
Copper "	108,064	15,655,221
Iron ore "	3,356,287	6,485,501
Pig iron "	3,182.715	49,191,732
Lead ore "	3,351	20.000
Pig lead "	1,143	96,000
Zinc ore "	7,704	92,410
Total	....	190,761,309

The total as given above is subject to a slight deduction, due to its including not only iron ore but also pig iron, into which some portion of it was doubtless smelted; but, after making allowances of this sort, the aggregate value cannot be less than one hundred and eighty million dollars.

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[1] 19th Rep. B.M., 1910, Part 1., p. 9.

Gold

Bullion was produced at fourteen properties last year, from none of them in large quantity. The principal contributor was The Canadian Exploration Company at Long lake. At Porcupine the Hollinger and Vipond mines operated small test mills previous to the fire, and the Dome recovered considerable gold in the laboratory. Other producers were the Kenora (formerly Mikado) and Olympia, both at Shoal lake; St. Anthony (Sturgeon lake); American Eagle and Detroit Syndicate, in Munro township; Gold Pyramid, in Guibord township; Swastika; Havilah (formerly Ophir); Dr. Reddick (Larder lake), and the Tingley prospect (Pelican lake). The number of men employed at the foregoing mines was 597, to whom wages were paid amounting to $442,519. It is evident from these figures that most of the labour was employed in development and construction work.

The revival of interest in gold mining caused by the discoveries at Porcupine and the developments now under way there has put new life into a number of the older fields, which for years have lain dormant.

In eastern Ontario the Belmont or Cordova mine, situated in the county of Peterborough, near the border line of Hastings county, is being unwatered and put in shape for a resumption of operations. There are a number of quartz veins on this property, some of them of large size, and the mill is equipped with thirty stamps.

The Elizabeth mine, on locations F M 171 and 172, Steep Rock lake, has been leased from Mr. W. H. Nelson, of Port Arthur, by the Elizabeth Gold Mining Company. Operations began on 1st May, 1911, consisting of pumping out the old shaft, and erecting a boiler house and 10-stamp mill. It was expected that the latter would be at work about 1st May, 1912.

The St. Anthony mine at Sturgeon lake was operated during the year by the Sturgeon Lake Development Company. Much work was done in the way of refitting the mine and stamping plant, which had lain idle for several years, and in thoroughly testing the ore bodies at various points. Only a small quantity of ore was actually treated, but the new owners are looking forward to a period of active gold production. The construction of the Transcontinental railway has greatly facilitated the conveyance of freight into Sturgeon lake, and to this extent has benefitted the mining industry there.

The gold area at Swastika, on the Temiskaming and Northern Ontario railway, near the northern boundary of Otto township, is being tested by the operations at the mine of the same name. Here a stamp mill has been put up, and fairly extensive underground workings made. There are other prospects in the same locality now also being opened up.

In Munro and Guibord townships the work in progress at the American Eagle, Detroit Syndicate and other properties will tend to show what may be expected from the auriferous veins of that neighbourhood. The low-grade bodies at Larder lake have not yet produced much gold, but there are prospects that some of the properties being exploited here may eventually prove to be mines.

It is, however, unnecessary here to discuss at further length the various camps where gold is being obtained or sought after, including Porcupine itself, since they are fully described in the report of Mr. E. T. Corkill, Chief Inspector of Mines, in this volume. The newest field of all is West Shining Tree lake, in the Temagami Forest reserve, where free gold was found last summer in bodies and under conditions resembling those at Porcupine. This area forms the subject of a report by Mr. R. B. Stewart, which will be found in this volume, accompanied by a map illustrative of the geology.

Silver

The quantity of silver produced last year was 31,507,880 fine ounces, for which the mine-owners received a total of $15,953,895. This compares with an output for 1910 of 30,651,417 ounces, worth $15,481,322, being an increase in quantity of 856,463 ounces, and in value of $472,573. The entire production was from the mines of Cobalt and its subsidiary camps, South Lorrain and Gowganda, with the exception of 89 ounces recovered from the bullion of gold mines. From the time of their opening in 1904, the Cobalt mines have had a total output of almost 126 millions of ounces, worth over 64 millions of dollars.

The Producing Mines

The number of producing mines was 34, counting as one mine all the properties owned by the same company or firm. The largest producers were the following:—

	Ounces shipped.
Nipissing	4,678,074
La Rose	4,092,709
Crown Reserve	3,430,902
Coniagas	3,273,464
McKinley-Darragh-Savage	2,569,654
Kerr Lake	2,238,353
Buffalo	1,644,245
O'Brien	1,397,546
Temiskaming	1,213,754
Hudson Bay	1,067,667
Wettlaufer-Lorrain	925,017
Beaver	888,875
Cobalt Townsite	834,948
Trethewey	770,838
Cobalt Lake	626,044
Miller Lake-O'Brien	338,000
Right of Way	289,718

The remaining mines on the producing list were City of Cobalt, Colonial, Nova Scotia, Peterson Lake, Hargrave, Drummond, Millerett, Cobalt Provincial, Casey Cobalt, Chambers-Ferland, Silver Cliff, Standard Cobalt, Green-Meehan, Belellen, Nancy-Helen, Wyandoh, King Edward.

Two mines in South Lorrain, namely, Wettlaufer-Lorrain and Belellen, produced 933,912 ounces, and two in Gowganda, Miller Lake-O'Brien and Millerett, 468,687 ounces. The total production was thus distributed between Cobalt and the smaller camps:—

	Ounces.
Cobalt proper	30,105,192
South Lorrain	933,912
Gowganda	468,687
Total	31,507,791

Progress in Concentration and Treatment

The shipments from Cobalt for the year comprised 17,278 tons of ore, 9,393 tons of concentrates, and 3,141,976 ounces of bullion, compared with 27,485 tons of ore, 6,874 tons of concentrates, and 980,633 ounces of bullion, in 1910. The tonnage shipments, however, have ceased to be an index to the activity or production of the mines, since concentration of low-grade ores and the adoption of refining processes on the spot have become marked features in camp practice. The result of these is to lessen the gross weight of the material requiring to be shipped away.

The natural evolution of the industry at Cobalt, as the high-grade ores tend to diminish in quantity or at any rate in proportion to the whole output, is bringing the low-grade material year by year into a position of greater importance. There are still shipments made of the leaner ores, and such will doubtless continue to be made during the life of the camp, but they are due to special circumstances in the mines from which they come, such as the absence of a concentration plant, or to the offer of a remunerative price by smelters looking for silicious ores to mix with more basic material. It is inevitable that economic causes will year by year diminish the proportion of ore shipped away, and increase the proportion of concentrates and refined bullion. The fourteen concentration plants which were at work in 1910 increased to seventeen by the end of 1911, and two others, at the Beaver and Nipissing Mines respectively, were in course of construction on 31st December. A further illustration of the tendency to carry treatment processes to the farthest possible point within the limits of the camp itself was provided by the management of the Nipissing mine, where a mill was installed last year for the treatment of the high-grade ores of that mine. After fine grinding the ore is subjected to an ingenious combination of cyaniding and amalgamation, which has proven both efficient and economical.

The concentrating plants at the end of 1911 had a total capacity of about 1,730 tons of ore per day. During the year the quantity of ore subjected to concentration was 387,782 tons, which produced 9,443 tons of concentrates. Shipments amounted to 9,393 tons. The bulk of the ore was treated in the works of the mines from which it was raised, but a considerable tonnage was manipulated at the custom plants of the Northern Concentrators, Nova Scotia, and Nipissing Reduction Companies, Dividing the quantity of silver recovered by the number of tons of ore put through the concentrators would give 21.6 ounces of silver recovered per ton of ore. On the assumption that the average recovery was about 85 per cent., it would seem that the average contents of the ore, as it was sent to the mills, was about 25.4 ounces per ton.

Refining Cobalt Silver Ores

In the table showing the production of silver from the mines of Cobalt, the several forms in which the silver leaves the camp are classified as ore, concentrates and bullion. The actual shipments out of the province of ore and concentrates, are, however, much smaller, and the shipments of bullion much larger, than the figures would indicate There were four refineries in Ontario running on ore from Cobalt in 1911, namely, the Canadian Copper Company, whose works are at Copper Cliff, the Coniagas Reduction Company, Limited, at Thorold (head office, St. Catharines), the Deloro Mining and Reduction Company, Limited, at Deloro, in the county of Hastings and the Canada Refining and Smelting Company, Limited, Orillia, the last-named of which began operations during the year. At these works, there were treated, in 1911, 9,330 tons of ore and concentrates, the silver product of which was 17,756,651 fine ounces. Adding to this, the bullion produced in the Cobalt camp itself, the proportion of the entire silver yield for last year refined in Ontario amounted to 66 per cent., leaving only 34 per cent. to be extracted in other countries. As in former years, low-grade ores formed the bulk of shipments to points outside. A quantity of very high grade material, however, was exported for refining in Germany.

It may be a source of surprise that the silver refineries so far established have chosen locations at a considerable distance from the mines. This has been due to a variety of reasons. The great nickel-copper smelting works already in existence at Copper Cliff provided the Canadian Copper Company with skilled management and labor for a silver refinery at that point; at Deloro, the plant formerly operated by the Goldfields, Limited, on the auriferous mispickel of that locality, with its equipment of furnaces for the recovery of arsenic, etc., acquired on favorable terms by the new company served as a nucleus for the silver refining works; while at Thorold and Orillia, hydraulically developed electrical power was available at low rates. These advantages were deemed to be more than sufficient to offset proximity to sources of ore supply and the minimizing of railway freight charges.

In the following figures are summarized the operations of the Ontario silver refineries for 1911:—

Ore received, tons	9,142
Ore treated, tons	9,330
Silver recovered, fine ounces	17,756,651
Value of ditto	$9,248,829
White arsenic recovered, lb.	4,234,945
White arsenic shipped, lb.	4,341,078
Value of ditto	$74,609
Cobalt oxide shipped, lb.	62,859
Value of ditto	$42,979
Mixed oxides, cobalt and nickel shipped, lb.	388,139
Value of ditto	$67,600
Workmen employed, number	398
Wages paid	$283,134

The various products, other than silver, obtainable in the refining of the Cobalt ores, namely, cobalt, nickel and arsenic, are dealt with under their respective headings.

Ore Markets during the year

The objections made by the buyers of silver ore to the ores of the Cobalt mines when they were first placed on the market, owing to their unique character, have disappeared, and there is now no difficulty in disposing of the product, whether as ore or as concentrates. Outside of the four Ontario refining companies above mentioned, the chief ore purchaser was the American Smelting and Refining Company, which took consignments for its works at Denver, Col., and Perth Amboy, N.J. Beer, Soudheimer & Company, of Frankfort-on-the-Main, Germany, and the Government of Saxony, both took a quantity of high-grade ore. Other purchasers were the Pennsylvania Smelting Company, Pittsburgh, Pa., whose plant is at Carnegie, Pa.; the United States Metals Refining Company, of New York (works at Chrome, N.J.), and Balbach Smelting and Refining Company, Newark, N.J.

There is no agreement or common plan among the ore purchasing companies, as to prices or terms. The Canadian Copper Company, for example, pays for 84 per cent. of the silver contents for ore assaying from 200 to 500 ounces per ton, 85 per cent. for ore assaying from 500 to 600 ounces, and so on, up to 96½ per cent. for ore running 5,000 ounces and upwards. Payment for 70 per cent. of the silver is made thirty days after completion of sampling, and 30 per cent. thirty days later. The Coniagas Reduction Company pays for 55 per cent. of the silver contents for ores assaying 50 ounces per ton, and up to 91.5 per cent., 92.5 per cent., 93.5 per cent., and 95 per cent., respectively, for 1,000-ounce, 1,500-ounce, 2,000-ounce, and 3,000-ounce material. The American Smelting and Refining Company's terms vary with the quantity of ore contracted for, etc., but it pays for 95 per cent. of the silver, and makes a treatment charge of $7.00 per ton, dry weight, also an additional charge of 25 cents per ton for each per cent. of arsenic in excess of 5 per cent. The Saxon Government buys only ore that will assay 4,500 ounces per ton or over, and pays for 96 per cent. of the silver contents. Other ore-buying concerns show similar variations in their purchasing tariffs. The New York price of silver governs transactions on this Continent, and Hamburg quotations rule those with Germany.

Silver Prices

Silver prices remained steady during the first nine months of the year, but speculation in India and China, and the rebellion against the Manchu dynasty in the latter country raised them to a somewhat higher level for the months of November and December. The New York average for January was 53.795 cents per ounce; this fell to 52.222 in February, recovered to 53.325 in April, fell again to 52.630 in July, and to 52.440 in September, rose in October to 53.340, and in November to 55.719, closing in December at 54.905. The lowest point, 52.171 cents, was touched in August, and the highest in

November; the average for the year being 53.304 cents per ounce, as against 53.486 in 1910. Two features of the world's silver situation remain constant; the great mart is London, the great consumer is the East. To the old-established brokers in London go the merchantable bars, not only from Canada, but from the United States and Mexico, whose united production is equal to 83 per cent. of the entire yield of the world; and from London a large proportion, varying according to crop prospects and conditions of trade and politics, is exported to the bazaars of India and the commercial centres of China. India is the chief buyer, but a considerable share of her imports is coined into British dollars at the Bombay mint and re-exported for use in Hong Kong. Taking India and China together, their imports of silver bars from London amounted to £9,835,000 in 1911, being an increase of £1,165,000 over 1910. In addition, China received £1,900,000 from San Francisco. Russia and Germany were also important purchasers of silver, the former taking £1,752,647 from London, and the latter £1,725,335. France also took £940,283, and Brazil £216,136.

The course of silver prices for the future is impossible of prediction. The cheapening of the metal has of late years greatly favored its employment in the arts, for plate, etc., and the requirements of commerce in the trading nations of the world will ensure a steady demand for coinage purposes. The reforms in the currency system of China, which were undertaken by the Imperial Government before its overthrow by the Republican forces, will, it is expected, be hastened by the new rulers of that country, and this will necessitate the use of a very large quantity of silver. It is proposed to substitute for the "tael," which varies in weight and value in the various Provinces of China, a standard dollar, having a weight of 414.5 grains, and a fineness of 900. Some of these coins have already been issued. On the other hand, there are those who allege that the popularity of silver, which for centuries has been the favorite medium for hoarding there, has begun to wane in India. They point to the fact that, after deducting amounts re-exported from amounts imported, the home consumption for the year ending 31st October, 1911, was only 44,000,000 ounces, as against 56,400,000 ounces in 1910, and 60,843,000 ounces in 1909. Everyone who has paid any attention whatever to Asiatic affairs during the past few years is aware that a tremendous awakening is taking place in almost every department of life in the East, and this awakening is not confined to Japan or China, but extends to India, Siam, Persia, and to practically all the nations of the Orient. A very decided feature of the movement is the tendency to adopt Western methods in education, politics, and finance. It is alleged that the diminishing use of silver for investment is accompanied by larger purchases of gold, especially by the wealthier classes, who find gold more convenient and less subject to fluctuations in value. Whether this preference will eventually work a change in the deep-rooted custom of putting their savings into ornaments and objects of silver, which has characterized the people of India from time immemorial, remains to be seen. The East is no longer "the unchangeable," and no one can prophesy what will happen.

Production of silver will continue at Cobalt regardless of whether the price of silver falls or rises, since the ores are so rich as to leave a wide margin over the cost of operating. Nevertheless the fluctuations of the market, in view of the largeness of the output, are of great consequence to the camp. An increase of one cent per ounce on the production of 1911 would have brought the mine-owners $314,998 more than they actually received, while three cents an ounce would have given them an additional return of nearly a million dollars.

Tables V. and VI., which follow, give respectively the annual production of silver from the Cobalt mines, and the total annual value of all constituents in the ore. In Table VI., the values allotted to cobalt and arsenic are those realized by the refining companies:—

Table V.—Silver Production, Cobalt Mines, 1904 to 1911

Year.	Producing Mines.	Shipments.			Silver Contents.			Ave'ge Silver Contents per Ton.		Value of Silver Shipments.			Total Value.
		Ore.	Concentrates	Bullion.	Ore.	Concentrates.	Bullion.	Ore.	Concentrates.	Ore.	Concentrates.	Bullion.	
	No.	Tons.	Tons.	oz.	oz.	oz.	oz.	oz.	oz.	$	$	$	$
1904	4	158	....	....	206,875	....	....	1,309	....	111,887	....	....	111,887
1905	16	2,144	....	....	2,451,356	....	....	1,143	....	1,360,503	....	....	1,360,503
1906	17	5,335	....	....	5,401,766	....	....	1,013	....	3,667,551	....	....	3,667,551
1907	28	14,788	....	....	10,023,311	....	....	677	....	6,155,391	....	....	6,155,391
1908	30	24,487	1,137	....	18,022,480	1,415,395	....	736	1,244	8,468,293	665,085	....	9,133,378
1909	31	27,729	2,948	....	22,436,355	3,461,470	....	809	1,174	10,809,872	1,651,704	....	12,461,576
1910	41	27,437	6,845	980,633	22,581,714	7,082,834	980,633	821	1,030	11,360,489	3,590 098	527,460	15,478,047
1911	31	17,278	9,375	3,141,976	20,318,626	8,056,189	3,132,976	1,176	858	10,250,991	4,017,241	1,685,615	15,953,847
Tl..	..	119,356	20,305	4,122,609	101,442,483	20,006,888	4,113,609	850	985	52,184,977	9,924,128	2,213,075	64,322,180

Table VI.—Total Production, Cobalt Mines, 1904 to 1911.

Year.	Shipments, ore and concentrates.	Nickel.		Cobalt.		Arsenic.		Silver.		Total Value.
	Tons.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Ounces.	Value.	
			$		$		$		$	$
1904.....	158	14	3,467	16	19,960	72	903	206,875	111,887	136,217
1905.....	2,141	75	10,000	118	100,000	549	2,693	2,451,356	1,360,503	1,473,196
1906.....	5,335	160	....	321	80,704	1,440	15,858	5,401,766	3,667,551	3,764,113
1907.....	14,788	370	1,174	739	104,426	2,958	40,104	10,023,311	6,155,391	6,301,095
1908......	25,624	612	....	1,224	111,118	3,672	40,373	19,437,875	9,133,378	9,284,869
1909.....	30,677	766	....	1,533	94,965	4,294	61,039	25,897,825	12,461,576	12,617,580
1910.....	34,282	504	....	1,098	54,699	4,897	70,709	30,645,181	15,478,047	15,603,455
1911......	26,653	392	....	852	170,890	3,806	74,609	31,507,791	15,953,847	16,199,346
Total ..	139 661	2,893	14,641	5,901	736,762	21,697	306,288	125,971,971	64,322,180	65,379,871

Labour

In the operating silver mines, there were 3,097 men employed, on the average, throughout the year, receiving $2,638,617 in wages. These figures take no account of the very considerable quantity of labour expended on non-producing mines, or in the performance of assessment work on mining claims, statistics regarding which it is impossible to obtain. The cobalt silver-refining works gave employment, in addition, to 398 workmen, to whom were paid in wages $283,134. In producing and treating the silver ores raised in 1911, 3,555 employees were engaged, earning an aggregate of $2,977,721 in wages. Boys are not largely employed in Ontario mines, only 57 being noted on the returns, all of them working above ground. No female labor whatever is permitted either in mines or mining works, except in a clerical capacity, an exception being made of mica-splitting plants, the work in which is light and of a kind requiring dexterity of manipulation.

There were no serious labour difficulties during the year. The demand for skilled miners was good, but not in excess of the supply. Wages at Cobalt, Porcupine, and in the north-west part of the Province were about as follows:—Miners, hoistmen, mechanics, $3.50 per day, firemen, $3.00, muckers and labourers, $2.50 to $2.75. A large proportion of the unskilled labour and a smaller percentage of the skilled labour is performed by workmen of foreign extraction. Many of these are imperfectly acquainted with the English language, and do not mix readily with the English-speaking population. Superintendents vary in their estimates of the efficiency of foreign labour, but all agree that for the heavier manual work, they can get scarcely any other. The manager of a gold mine, west of Lake Superior, who has had his difficulties with mine labour, stated that, at the date of his letter, the following nationalities were represented on his pay-roll:—Canadian, 8; Americans, 5; Finlanders, 4; Croatians, 2; Indian, 1; Irish, 1; Scotch, 2; Swede, 1; German, 1; Norwegian, 5; Bohemian, 1.

Dividends

The statement given of dividends declared or paid by silver-mining companies at Cobalt shows that last year they divided the sum of $8,733,958.16 among their shareholders. Up to 31 December, 1911, the total amount paid out in dividends was $30,198,004.44. This is exclusive of profits earned by privately owned mines or close corporations, such as the O'Brien and Drummond. If these were added, the total dividend return would approximate 35 million dollars, or equal to more than half the gross value of the silver recovered. The following mines have now returned to their shareholders dividends exceeding in amount the par value of their share capital: Buffalo, Crown Reserve, Kerr Lake, Nipissing, Temiskaming and Hudson Bay. It should be pointed out, however, that, in the case of the Kerr Lake, Nipissing and Temiskaming and Hudson Bay mines, the original company has been practically succeeded by a subsequently formed corporation with a much larger nominal capitalization.

It is natural to compare Cobalt with others of the world's famous mining districts. Rich as it undoubtedly is, it has been surpassed in gross returns by other bonanzas. For instance, in 1911, thirty-five South African gold mines, mainly on the Rand, paid out dividends aggregating $35,000,000. One company alone, the Crown Mines, Limited, paid out $5,493,978; another, the Robinson, $4,017,750. Even these were surpassed by the Goldfield Consolidated in the State of Nevada, the largest producing gold-mine in the world, whose dividends in 1911 amounted to $7,118,296. The total of the dividends paid by this Company to date is $22,771,322. The Homestake gold mine, South Dakota, has paid $28,522,040; the Alaska Treadwell, $12,510,000; the Portland, Colorado, $9,097,080; Camp Bird, Colorado, $8,383,562; Standard Consolidated, California, $5,229,809. There are a number of silver-producing mines whose total payments have equalled or exceeded those of any of the Cobalt mines, but all of them realized on some other element or elements in addition to silver, mainly lead, gold or copper. Thus the Bunker Hill and Sullivan mine, in the State of Idaho, which produces lead and silver, has paid out $13,715,550 in dividends; the Tonopah, of Nevada, silver and gold, $9,250,000; El Oro, Mexico, gold and silver, $10,835,127. Of all the metals, however, copper has been the most fruitful in bonanza deposits. The Nevada Consolidated mine has paid in dividends up to the present time $8,977,870; North Butte, Montana, $10,248,000; Utah, $15,057,453; Calumet and Arizona, $15,478,118; United Verde, Arizona, $30,997,000. In the native copper region of Michigan, the Osceola mine has paid out $10,593,200; the Copper Range Consolidated, $12,709,988; the Quincy, $20,363,000. These, however, pale before the record of the Anaconda mine in Montana, which has returned to its shareholders $65,171,250, and the Calumet and Hecla, whose dividends have reached the colossal sum of $118,850,000.

All the foregoing mines, however, are distinguished from those of Cobalt in two particulars. For the most part they are situated on deposits of great size, and their tenor in metallic contents is low. For example, the Calumet and Hecla ore contains on an average less than 2 per cent. copper, and much of the rock treated carries less than 1 per cent. This is true of the native copper mines of Michigan generally. On the other hand, the quantity of material treated is very great. At the Calumet and Hecla 8,500 tons of ore are put through the stamp mills daily. The ore of the Anaconda mine contains less than 3 per cent. copper, and less than 2 ounces of silver per ton. Yet in one year 1,110,000 tons of ore were treated, yielding 31,500 tons copper, 2,001,000 ounces silver and 8,290 ounces of gold.

The mines of Cobalt present an entire antithesis. The veins are narrow, mostly quite limited in length, and some of them fail to carry their values to a great depth or through a change in the rock formations. But they are remarkably high in grade, running up to 8,000, 9,000 and even 10,000 ounces of silver per ton for carload lots. Their operation requires a minimum of labour and capital, and the consequence is that of the whole output up to date, one-half the gross value has been distributed as dividends and profits. In this respect it is doubtful if a parallel can be found in the annals of mining anywhere.

Following is statement of dividends:—

Table VII—Dividends Declared and Paid by Silver-Cobalt Mining Companies to end of 1911.

Name of Company.	Date of Incorporation.	Authorized Capital.	Capital Stock issued.	Par value per share.	Amount of Dividends and Bonuses declared to end of 1910.	Amount of Dividends and Bonuses declared during 1911.	Total of Dividends and Bonuses declared to Dec. 31, 1911.	Last Dividend or Bonus.	
								Date declared.	Rate per cent.
		$	$	$	$ c.	$ c.	$ c.		
Beaver Consolidated Mines, Limited	Mar. 5, 1907	2,000,000	2,000,000	1.00	....	69,912 25	169,912 25	Sept. 9, 1911	3
Buffalo Mines, Limited	April 27, 1906	1,000,000	1,000,000	1.00	1,007,000 00	370,000 00	1,377,000 00	Dec. 4, 1911	13
City of Cobalt Mining Company, Limited	Oct. 5, 1906 Jan. 7, 1909	500,000 1,500,000	1,500,000	1.00	139,312 42	....	139,312 42	April 15, 1909	3
Cobalt Central Mines Company	Dec. 13, 1906	5,000,000	5,000,000	1.00	192,845 00	....	192,845 00	Aug. 25, 1909	1
Cobalt Silver Queen, Limited	April 1, 1906	1,500,000	1,500,000	1.00	315,000 00	....	315,000 00	Dec. 31, 1908	3
Coniagas Mines, Limited	Nov. 21, 1906	4,000,000	4,000,000	5.00	1,400,000 00	1,440,000 00	2,810,000 00	Oct. 31, 1911	9
Crown Reserve Mining Company, Limited	Jan. 16, 1907	2,000,000	1,999,957	1.00	2,653,221 00	1,061,288 40	3,714,509 40	Dec. 15, 1911	5
Foster Cobalt Mining Company, Limited	Feb. 14, 1906	1,000,000	915,588	1.00	45,000 00	....	45,000 00	Jan. 1, 1907	5
Kerr Lake Mining Company, Limited	Aug. 9, 1905	40,000	40,000	100.00	2,958,000 00	982,000 00	3,910,000 00	Oct. 10, 1911	350
La Rose Mines, Limited	Feb. 21, 1907	6,000,000	6,000,000	5.00	2,045,000 00	635,000 00	*2,680,000 00	Dec. 20, 1911	2.6166
McKinley-Darragh-Savage Mines of Cobalt, Limited.	April 9, 1906	2,500,000	2,247,692	1.00	†808,176 18	1,123,846 00	1,932,022 18	Nov. 13, 1911	10
Nipissing Mining Company, Limited	Dec. 16, 1904	250,000	250,000	100.00	6,482,500 00	1,813,297 25	8,325,797 25	Dec. 11, 1911	....
Right of Way Mining Company, Limited	July 13, 1906	500,000	500,000	1.00	324,643 93	....	324,643 93	....	....
The Right of Way Mines, Limited	Sept. 11, 1909	2,000,000	1,685,500	1.00	168,550 00	33,710 00	202,260 00	Dec. 2, 1911	2
Temiskaming and Hudson Bay Mining Company, Limited	July 29, 1903	25,000	7,761	1.00	1,331,892 00	186,261 00	1,521,156 00	Nov. 27, 1911	300
The Hudson Bay Mines, Limited	July 16, 1909	3,500,000	3,200,051	5.00	143,751 00	251,151 76	391,902 76	Dec. 22, 1911	2
Temiskaming Mining Company, Limited	Nov. 16, 1906 Jan. 1, 1908	2,500,000	2,500,000	1.00	784,156 25	225,000 00	1,009,156 25	Sept. 30, 1911	3
Trethewey Silver Cobalt Mine, Limited	May 30, 1906 June 1, 1911	1,000,000 2,000,000	1,000,000	1.00	661,998 50	200,000 00	861,998 50	June 16, 1911	10
Wettlaufer-Lorrain Silver Mines, Limited	Nov. 30, 1908	1,500,000	1,416,590	1.00	....	212,488 50	212,488 50	Nov. 27, 1911	5
Total	....	....	....	....	....	8,733,958 16	30,198,001 41	....	....

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*In addition to profits to owners previous to May 31, 1908, amounting to $1,204,862.72.
†In the 20th Report, p. 20, the amount is given as $1,145,309.48; this, however included the first dividend paid in 1911.

It may be of interest to summarize the annual reports of several of the leading Cobalt companies published for the information of their shareholders, so that a closer view may be had of the operation of these important concerns, which will bear comparison in point of efficiency with well managed companies anywhere. The companies selected are the Nipissing, Crown Reserve, Kerr Lake, Coniagas, La Rose, McKinley-Darragh-Savage.

Nipissing

The report is for the calendar year 1911. There were shipped 4,678,074 ounces of silver, having a value of $2,506,608, the average price received being 53.582 cents per ounce. The production was from the following sources:—

	Tons.	Ounces.
High-grade ore	735.94	1,761,536
Low-grade silicious ore	1,859.01	507,895
Concentrates	243.38	243,519
Silver bullion	76.29	2,165,124
Total	2,914.62	4,678,074

The gross quantity of silver produced was 5,197,042 ounces, there remaining on hand at the close of the year 744,116 ounces in ore, etc., not shipped. The gross cost of production based on this quantity was $725,015.77, or 13.95 cents per ounce. Individual items of cost were: Mine operation, $464,015.67; high-grade mill, $59,403.48; custom milling, $52,598.24; depreciation, $38,401.12; marketing product, $138,247.18; corporation, U. S. taxes, New York office and travelling expenses, $19,518.38; total, $772,184.07. Deducting rents and interest, $47,168.30, left the net cost $725,015.77. Under the head of mine operation the largest items were trenching, $8,831.58; development and exploration, $187,873.45, and stoping, $72,967.25, or a total for actually working the ground of $269,672.28; insurance and Canadian taxes were $74,943.23; administration and office, $24,190.06; ore sorting and loading, $23,791.68; boarding-house and camp maintenance, $19,576.87; general and legal expense, $19,524.42, etc. The net value received from sales was $2,381,712.54, and the net income $2,095,241.23.

The total shipments of silver from the opening of the mines in 1904 amounted to 23,023,313 ounces, and the gross value of the silver contents, plus cobalt, nickel and arsenic paid for was $12,939,395.18, the net value received from smelters being $11,820,620.84. Dividends paid during the year were $1,843,297.25. The ore reserves are figured as follows:—

	Tons.	Ounces.
High-grade ore	3,454	6,126,838
Mill rock on dump	80,036	1,756,954
Total	83,490	7,883,792

A year ago the reserves were placed at 6,552,880 ounces. A new mill for treating the high-grade ore was devised by Mr. Charles Butters, consulting engineer, and has proved highly satisfactory in its operation. The process consists essentially of amalgamation in cyanide solution in a tube mill, where more than 97 per cent. of the silver in the ore is recovered as amalgam. The residue then undergoes the regular cyanide treatment, whereby an additional extraction is made. During the summer a refinery was erected, since which time the whole product of the mill has been shipped as fine bullion. A mill for the treatment of the low-grade ore is in course of construction which will have a capacity of 200 tons of ore per day.

Crown Reserve

During 1911 there was produced and shipped from the Crown Reserve mine 3,430,902 ounces of silver, of a gross value of $1,833,516.80, derived as follows:—

	Tons.	Ounces.
High-grade ore	644.561	2,991,404
Low-grade ore	390.256	64,284
Bullion	7.952	221,792
	1,042.769	3,277,480
Milled ore (shipped as bullion)	5.820	153,422
Total	1,048.589	3,430,902

The cost of mining and all other expenses at the Crown Reserve mine, including development, depreciation, etc., amounted to $299,668.10, smelter charges and deductions to $82,216.59, bonus to employees to $9,147.45, and royalty to Ontario Government, accrued and accruing, at the rate of 10 per cent. on the value of the ore at the pit's mouth, to $162,744.87, leaving a profit for the year of $1,279,739.79, out of which $123,-903.64 was paid for prospecting, exploring and working the Silver Leaf ground adjoining the Crown Reserve mine leased by the company, and similar operations in the McEnaney gold mining claim at Porcupine on which the company holds an option; also dividends at the rate of 60 per cent., amounting to $1,061,288.40. The total production of the mine, beginning with 1908, was 12,512,377 gross ounces of silver, having a net value of $6,135,290.68. The average cost of the silver produced in 1911 is given as 10.671 cents per ounce. Dividends paid to date amounted to $3,714,509.40. No estimate is made of the amount or value of the ore left in the mine, but the report states that the quantity in sight is greater than it was a year ago.

Kerr Lake

The fiscal year of the Kerr Lake Mining Company ends 31st August, so that the last annual report covers the year terminating on that day, 1911. Shipments from the mine were as follows:

	Tons.	Ounces.
First-grade ore	481.376	1,722,092
Second-grade ore	1,270.572	460,121
Jig concentrates	30.501	28,300
Bullion from metallics	......	12,964
Sluices	153.930	11,669
Dump	......	34,534
Total		2,269,680

There were on hand silver contents of ore not shipped 31st August amounting to 118,740 ounces, bringing the total production up to 2,388,420 ounces. Proceeds of ore sales and interest brought in $1,231,245.82, against which there were charged cost of production and development, $232,082.88; shipment, treatment and other charges, $52,449.26; administration and general expenses, $9,334.42, leaving a net profit of $937,379.26. The balance on hand at the beginning of the company's year was $1,110,437.72, making a total available for distribution of $2,047,816.98, out of which were paid dividends amounting to $1,338,000, leaving a balance to be carried forward of $709,816.98, of which $240,000 was ear-marked for dividend to be paid 15th September, 1911. Cost of production of silver is placed at 14.69 cents per ounce. In all $3,330,000 has been paid in dividends since the opening of the mine in 1906. Manager John Seward concludes his report as follows: "On account of the great irregularity which he finds in the ore deposits, your manager does not feel warranted in making an estimate either of the total ore in sight in the mine, or of the value of the probable ore. Recent developments have shown that portions of the mine formerly regarded as ore-bearing have been practically barren, whereas other areas from which nothing was expected produced a large amount of silver. It is safe to say that we can continue at the present rate of production for from one to two years longer without taking into consideration other undeveloped portions of the property."

Coniagas

The report of the Coniagas Mines, Limited, is very full and copiously illustrated with plans and sections, showing the surface plant and underground workings. It covers 12 months, ending 31st October, 1911. During the year there were mined and shipped 3,789,274 ounces of silver at the remarkably low cost of 8.8 cents per ounce, including mining, concentrating, freight to smelter, sampling, assaying and treatment charges, and all head office expenses and royalties, as compared with a corresponding cost for the previous year of 13.285 cents per ounce. The output of the mine was as follows:—

	Tons.	Ounces.
Ore	619.1	2,142,536
Concentrates	1,418.4	1,643,616
Total	2,037.5	3,789,274

The total shipments to 31st October, 1911, from the opening of the property in 1905 amounted to 4,243.2 tons of ore, containing 5,928,304 ounces of silver and 2,489.9 tons of concentrates, containing 3,193,492 ounces—a total of 7,360.6 tons shipped, with aggregate contents of 10,582,128 ounces of silver. The working account shows receipts from ore, $1,914,320.22; miscellaneous, $33,245.85; in all, $1,947,566.07. Against this, mining expenses footed up to $149,501.80; milling ditto, to $57,715.75; sale of ore to $35,054.73; taxes and royalties to $17,279.21, and other charges of necessary expenditure, the whole amounting to $333,463.92, and leaving at credit of Loss and Gain, $1,614,102.15. Out of this $1,440,000 was appropriated to meet four quarterly dividends and bonuses at the rate of 36 per cent. for the year, making 71 per cent. of the capital stock to date returned to shareholders in dividends and bonuses. Ore in reserve is estimated as containing 12,516,000 ounces of silver, about the same quantity as two years ago, after shipping since that time 5,718,805 ounces.

La Rose Consolidated

For the calendar year 1911 shipments from La Rose Consolidated Mines were as follows:—

	Tons.	Ounces.
Silver-cobalt-nickel ore	1,770.995	3,066,490
Low-grade silicious ore	603.204	112,066
Nuggets	12.262	274,599
Concentrates	1,174.951	639,554
Total	3,561.412	4,092,709

The actual production was considerably less, being 3,429.514 tons, containing 3,691.797 ounces. Of this 1,214.683 tons, containing 1,439,113 ounces were obtained from La Rose mine; 659.921 tons, containing 1,221,130 ounces from the Lawson; 408.743 tons, containing 429,014 ounces from the Princess; the remainder consisted of 1,146.166 tons of concentrates, mainly from La Rose mine, carrying 602,540 ounces. The report figures profits on the production of the year, not the shipments. Receipts thus based were $1,977,764.67, from which the cost of production, amounting to $708,678.90 in all, fell to be deducted, thus leaving a net surplus of $1,269,085.77, or 64 per cent. of the gross value of the silver produced. The chief items of expense were development and exploration, $125,474.78; stoping, $59,408.01; tramming, $54,325.59; ore sorting and loading,

$48,016.91; insurance and taxes, $30,298.52; administration and office, $28,560.17. From the profits dividends amounting to $627,000 were declared, plant account was increased by $1,266.27, and the balance, $640,819.50, was added to the net current surplus, making the latter $1,444,385.61.

The report states the company's decision to be " not to distribute this surplus in the form of largely increased dividends or bonuses," but, after providing for payment of 10 per cent. on the company's capital, and in view of the fact that it " has still a large undeveloped area, to continue the vigorous policy of development which has produced such satisfactory results during the past two years, and, as opportunity presents, acquire interests in other mining enterprises which after thorough examination and reports of the most competent and reliable engineers, are considered proper investments for the company's funds." La Rose Consolidated includes La Rose proper, La Rose Extension, Princess, Fisher-Eplett, Violet, University and Lawson mines, but only La Rose, Lawson and Princess produced silver last year. The report notes with satisfaction that the Lawson made a good record for the year, and that a small shoot of ore recently found in No. 8 vein produced 15.2 tons of ore assaying 9,656 ounces of silver per ton.

McKinley-Darragh-Savage

In 1911 there were recovered from the two properties worked by this company 2,654,177 ounces of silver—2,043,578 ounces from McKinley-Darragh and 610,599 ounces from Savage. The sources of the silver are classified in the report as follows:—

	Tons.	Ounces.
Nuggets	2.526	50,166
No. 1 ore	469.279	822,571
No. 2 ore	17.158	7,479
No. 1 picking belt	96.711	153,591
No. 2 picking belt	85.141	35,758
Jig concentrates	581.971	714,566
Sands	751.086	545,312
Sluices and fines	1,222.155	324,734
Total	3.226.027	2,654,177

Of this quantity, 2,569,654 ounces were marketed, realizing $1,368,216.86. The cost of marketing amounted to $135,912.76, and, after deducting ore remaining on hand, the net value was $1,299,777.55. Cost of production footed up to $350,287.81, plus administration, $13,710.20; taxes, $21,430.89; insurance, $2,885.85; and stock and dividend expenses, $5,519.85—in all, $393,834.60. This left a net profit on the operations of $905,-942.65, or, adding interest received, of $916,864.73. Dividends amounting to $1,011,461.40 were paid out. To date shipments from these two mines have yielded 7,930,114 ounces of silver, and the estimate of reserves is 126.410 tons of ore, containing 5,561,780 ounces of silver. This includes only "ore actually blocked out," and makes no allowance for probable ore which may be developed hereafter adjacent to that now actually in sight. The cost of production is put at 17.52 cents per ounce for McKinley-Darragh and 20.39 cents for Savage; combining the two, it is found to be 18.78 cents.

Putting in tabular form the leading particulars respecting this group of Cobalt mines, we have the following results:—

Mine.	Silver produced last Company year. Ounces.	Gross Income. $	Gross Expenditure. $	Net Income. $	Cost of producing silver per ounce. cents.	Total silver produced to date. Ounces.	Estimated reserve of silver. Ounces.
Nipissing.........	5,197,012	2,867,425	772,184	2,095.241	13.95	23,023,313	7,883,792
Crown Reserve...	3,430,902	1,833,516	553,777	1,279,740	10.67	12,512,377	....
Kerr Lake........	2,388,420	1,231,246	293,866	937,379	14.69	....	....
Coniagas..........	3,789,274	1,947,566	333,464	1.614.102	8.80	10.582.128	12,516,000
La Rose Con......	3.691.797	2,008,127	739,041	1,269,086	19.20	14,902,595	4,250,861
McKinley-Darragh-Savage	2,654,177	1,446,612	529,747	916,865	18.78	8,052,793	5,561,780
Total.........	21.151.612	11,331,492	3,222,079	8,112,413	Av. 15.23	....	....

Steam Displaced by Water Power

For the operation of the Cobalt mines and works, steam power has been almost wholly displaced by hydraulic power delivered either by the electric current or in the form of compressed air. Most of the mines formerly using steam retain their plants for use in case of emergency, but the regular employment of steam is now confined to small and isolated properties. An amalgamation took place between the companies producing power on the Montreal river, the Cobalt Power Company and the Cobalt Hydraulic Power Company uniting to form the Northern Ontario Light and Power Company, Limited. This arrangement enables the plant at Hound chute to confine its supply to electrical energy only, while the Taylor compressed air system installed at Ragged chute fills the contracts for compressed air. Mines Power, Limited, whose development on the Matabitchewan was first in point of time to put electric power into Cobalt, has changed its name to the British Canadian Power Company, Limited.

On both the Montreal and Matabitchewan rivers, though the shortage of water was not so marked during the winter of 1911-12 as it was in the previous year, experience has shown the present means of conserving the freshet flows to be insufficient for the steady delivery all the year round of the maximum quantity of power. The watersheds of the Matabitchewan and the Montreal have both their peculiarities. The former is not extensive, being restricted on th north by that of the Montreal, and being still further narrowed by the tendency of the river to approach the Montreal as it nears its mouth, the actual entrance of the two rivers into Lake Temiskaming being only a few yards apart. For this reason, strict economy must be practised in the use of water, and the company has found it necessary, in addition to the reservoirs already in existence, to erect dams at the outlet of Bear, Cross and Macdonald lakes. When these are completed, practically all the natural storage grounds on the stream will be under control.

The Montreal is a longer and larger river than the Matabitchewan, but the area which it drains is lessened by the doubling, tortuous course which it pursues, especially in its southern branches. It receives a portion of the overflow of Lake Temagami through the northern outlet of that lake, the main discharge of which is to the south by the Temagami river, a feeder of the Sturgeon. Being thus situated on the height of land, the waters of this large and important lake, if conserved, are capable of considerably augmenting the water power of either or both the streams into which it empties. It is also evident that by adjusting the height of the dams at the northern and southern outlets, a larger or smaller proportion of the total discharge from the lake could at will be diverted into either system. There are important hydraulic developments on both streams, on the former for power used mainly in the mines of Cobalt, and on the latter for the operation of pulp and paper mills at the town of Sturgeon Falls.

Lumbermen and Water Power Users

This situation is indicative of the classes of questions to which the rapidly increasing use of water power derived from the rivers of Northern Ontario is giving rise. But there is yet another, and very important, element in the situation. For many years, these rivers have been used by lumbermen to float their logs to market, and their right to employ them for such purposes has been repeatedly confirmed by the Legislature of the Province. Indeed, notwithstanding the extension of railways into the northern forests, and the increasing use which is made of them to transport logs, pulp-wood and other forest products to the place of consumption or manufacture, it is not easy to see how the great lumbering industry of Ontario could be carried on without the free use of these waterways.

There is nothing incompatible between the employment of flowing water for the carriage of sawlogs and its utilization for the development of power. But it is quite apparent that the presence of two distinct interests, each requiring the use of the water, but for a different purpose, is likely to be productive of friction. When the spring thaws and rains melt the snow and ice, and let loose the floods, the lumberman seizes the opportunity to get his " drive " to market. His logs in the water, he lifts the " stop-logs" from the dams and gives rein to the torrent that it may hurry his logs to their destination. Every consideration must yield to this—the logs must come down, for to be " hung up " means in most cases that another year will elapse before the logs will reach the saws, and also a loss in interest and the sinking of water-logged timber. The main body past, the rear-guard of his army " sweeps " the " tail of the drive," in other words, gathers up those logs which have stranded in shallow places, or have been caught by the rocks or other obstructions. This demands a fresh draft on the dammed-up lakes, in order to carry the " tail " down stream, and the freshet season may well be past or nearly so, before the lumbermen's use of the river is over for the time.

It is obvious that the owner of a water power on such a stream will find it difficult to obtain a maximum of power. The water is hurried away, which might have turned his turbines during the dry season, and his chances of equalizing the flow to the best advantage are correspondingly reduced. The situation is one which suitable legislation may be required to meet. Much may be accomplished by co-operation between water power owners and lumbermen, by improved log-slides requiring a minimum of water to operate them, by deepening river channels, and removing obstructions, etc., but it may also be necessary to provide some means of adjusting the relations between the lumbermen and water power owners, so far as the use of the water is concerned, and also between the various users of power on the same stream, whose interests may conceivably come at times into conflict.

Cobalt

The market for cobalt oxide continues depressed, and there is little relief in sight. The cobalt contents of their ores have ceased to be of value to the mine owners, but as they cannot produce silver without also producing cobalt, they continue to raise the latter, which is accumulating in the hands of the refiners. There is, however, a certain demand for refined oxide in the United States and Canada, and also from England and the continent of Europe. From the Canadian refineries were shipped 62,859 pounds of cobalt oxide, and 388,139 pounds of mixed cobalt and nickel oxides. In these mixed oxides, the proportion of (metallic) cobalt may be taken as varying from 40 to 50 per cent., and of nickel from 10 to 23 per cent. There was a further production of crude cobalt material or residues of 860,132 pounds, estimated to contain, say, 29 per cent. cobalt and 32 per cent. nickel. The mixed oxides go principally to the manufacturers of cobalt oxide on the continent of Europe, who seperate the cobalt oxide and market it under their own established brands. Reference was made in last year's Report to the alloy of cobalt and chromium, called " stellite," which displayed possibilities as a material for the manufacture of cutlery, but no important developments have yet taken place in this respect. There is room in the cobalt situation for a new use for this element which will absorb large quantities, and so widen the market.

The Metal Refining Bounty Act, 7 Edward VII., chapter 14, provides for the payment of a bounty of 6 cents per pound on the metallic cobalt contents of refined cobalt oxide produced in Ontario. The regulations framed under this Act restrict the bounty to actual shipments of the oxide from the works in which it has been refined. Claims for bounty were made by two of the refining companies on cobalt oxide shipped during the year as follows:—

Table VIII.—Statement showing Bounty paid Cobalt Oxide in 1911

Name of Company.	Cobalt Oxide. pounds.	Bounty. $
Deloro Mining and Reduction Company	35,083	1,432 20
Coniagas Reduction Company	19,410	1,164 60
Total	54,493	2,596 80

The Act was passed by the Legislature of 1907, and made provision for payment of bounties on refined copper, nickel, nickel oxide, cobalt, cobalt oxide, and arsenic produced from mispickel only. The bounties were to run for a period of five years from the date of the Acts, which would bring them to a close on April 1912, but during the session of 1912, the Legislature extended the bounty period for five years longer.

Nickel

From the mines of the Sudbury district there were raised, in 1911, 612,511 tons of nickel-copper ore, and at the blast furnaces of the mining companies there were smelted 610,788 tons of ore. The product was 32,607 tons of Bessemer matte, the nickel contents of which were estimated at 17,049 tons, valued at $3,664,474, or at the rate of 10.75 cents per pound. As compared with 1910, the production fell off somewhat, the output of matte being less by 2,626 tons, and of nickel contents by 1,587 tons. The production, however, was larger than in any previous year, with the exception of 1910, and towards the close of the twelve months, the mines were very active, and production was going on at full capacity rate. The number of employees at the mines and works was 2,439, of whom 35 were boys, all working above ground.

The producing companies were the same as in former years—the Canadian Copper Company, and the Mond Nickel Company. The former was the pioneer in the Ontario nickel mining industry and remains the largest producer. Its works are at Copper Cliff, and are maintained at a high level of efficiency. During the year 1911, ten acid converters for bessemerizing the low-grade matte produced in the blast furnaces were replaced by five basic converters, and two reverberatory furnaces were installed to treat about 50,000 tons of flue dust, the accumulation of years from the blast furnace dust chambers, also a similar accumulation of green ore fines from the mines, too small for use in the blast furnaces.

Of the 449,159 tons of ore mined by the Canadian Copper Company last year, 351,311 tons were taken from the Creighton mine, 66,023 tons from Crean Hill, and 34,825 tons from No. 2.

The Mond Nickel Company has hitherto had its smelting plant at Victoria Mines, west of Sudbury, in proximity to its mine of the same name. Recently, however, a new site has been selected at Coniston, near the crossing of the Canadian Pacific and Canadian Northern Railways, and new smelters there are well advanced towards completion. One advantage will be nearness to the Company's mine, in the township of Garson, from which the bulk of its ore is now obtained. In 1911, out of 163,352 tons of ore raised by the Mond Company, 116,932 tons came from the Garson mine, and 46,370 tons from Victoria No. 1.

Considerable diamond drilling was done on its properties, in the northern nickel range by the Dominion Nickel-Copper Company, but the mines have not yet reached the productive stage.

Owing to the absence of assay records, it is impossible to say, with accuracy, how many tons of nickel were contained in the ore taken from the silver mines of Cobalt in 1911. But, assuming that the percentage of nickel adopted in the Bureau's Report of last year for the ores and concentrates shipped from Cobalt, namely, 1.47, is approximately correct, this would give 392 tons of nickel produced by the mines of that camp. There can be no doubt that at least that portion of the nickel which is contained in the mixed oxides exported from the refineries finds its way into some industrial use. Adding, therefore, the 392 tons of nickel from Cobalt to the product of the Sudbury mines, a total of 17,441 tons of nickel is obtained as the output for the year.

Nickel Alloys

A third source of nickel is found in the township of Dundonald. Here, the Alexo deposit was discovered by Alex Kelso in 1908. The extent of the deposit has not yet been fully revealed, since the rock outcropping is of small area, but there seems reason to believe that ore may be present in some quantity. It much resembles the Sudbury ore, being pyrrhotite, but the copper contents are low. In nickel, the assays run up to 11 per cent., but there is considerable ore of much lower grade.

The study of nickel-iron alloys has not yet been exhausted. In the "Iron Age," for January 4, 1912, Sir Robert Hadfield refers to a series of experiments conducted by Dr. H. C. H. Carpenter, Mr. Percy Longmuir and himself, upon nickel steels containing varying percentages of nickel. Tests for tensile strength taken at the temperature of liquid air, – 182 degrees centigrade, showed that, as compared with 42 tons per square inch for pure (Swedish) iron, specimen F, containing 6.42 per cent. nickel showed 142.2 tons per square inch; specimen J, with 15.98 per cent. nickel, 144.2 tons, and specimen K, with 19.91 per cent. nickel, 157.2 tons per square inch. Apart from steel, in the form of wire, probably no such high tensile strength has ever before been obtained. The last specimen also exhibited an elongation on 2 inches of 15.5 per cent. At normal temperature, its tensile strength was 43.9 tons per square inch. Sir Robert makes this comment: "These results show that, if, in the future, such a material is required, then, in some artificial manner, such high tenacity will be obtainable. The results are remarkable, seeing that the tensile strength of an alloy composed chiefly of the metal iron can be raised about 3½ times above its original strength." Iron, in its pure state, has a tenacity of only 18 to 21 tons per square inch.

In the same issue of "Iron Age," the Pennsylvania and Maryland Steel Companies describe a new chrome-nickel steel, made by them from ore mined from the Mayari deposits on the Island of Cuba, estimated to contain 1,000,000,000 tons of ore. "Mayari" steel is made with any percentage of carbon from 0.03 to 1.50. Sulphur and phosphorus are below 0.04 per cent., the phosphorus, however, seldom being found as high as 0.02 per cent. The manganese may be as desired. The nickel varies from 1 to 1.25 per cent. The chromium content divides the steel into two classes; one contains from 0.20 to 0.40 per cent. chromium, and the other has a range of 0.40 to 0.70 per cent." A greater tensile strength of 8,000 to 10,000 lb. per square inch, and a higher elastic limit, is claimed for this steel in the rolled or forged condition, as compared with a carbon steel of the same carbon content. Compared with 3½ per cent., nickel steel, containing 0.40 per cent. carbon, Mayari steel, of like carbon content, is said to show a tensile strength and elastic limit from 10,000 to 15,000 lb. per square inch higher than the nickel steel, "except where the drawing temperature approaches the quenching temperature. Here the nickel steel is slightly superior, as in the case of annealed pieces. In the latter condition, Mayari steel lies about mid-way between the carbon steel and the nickel steel."

The great development of the automobile industry has afforded an outlet for large quantities of nickel steel, possessing, as it does, the union of strength and lightness essential for successful high-speed machines.

Nickel in Foreign Lands

A number of years ago, the nickel mines of Norway made not inconsiderable contributions to the world's output of this metal. These deposits are again being worked, notwithstanding their low grade. In 1911, the Evje Company raised about 25,200 metric tons of ore. The smeltery treated 24,000 tons from the mines at Slaa, 2,480 tons from the mines at Faœ, a separate company; 2,070 tons of ore imported from Greece, and about 120 tons of matte from France. The metal content of the matte produced was 418.5 tons of nickel, and 185 tons of copper. The old mines at Ringerike are being reopened, and the ore will be smelted at the mines to matte, which will be refined at the Christiansand nickel refinery. The latter, in 1911, produced 285 tons of electrolytic nickel, and 80 tons of copper. Its capacity is being extended to produce 600 tons of nickel, and 300 tons of copper per annum.[3]

Apart from Ontario, New Caledonia mines supply the greater part of the world's requirements of nickel. At present Ontario's contribution is about 70 per cent. of the whole. The annual report of the French Colonial Minister[4] shows that preparations are on foot to increase the output from New Caledonia, and that reduction of the ores to matte on the spot will henceforth be a prominent feature of the local practice. Speaking of the year 1910, the report states that there were in force 1,625 mineral concessions, covering an area of 770 square miles, though only 34 are being exploited. The chief metals extracted, in the order of their importance, are nickel, cobalt, chromic-iron and copper. Of the number of the concessions, 60 per cent. are worked for nickel, 17 for cobalt and 17 for chrome. Notwithstanding the large aréa granted for mining purposes, scarcely 4 per cent. are utilized. The *Echo des Mines* points out that a great advance has been effected by the erection of smelters for the reduction of the ores to mattes or metal, so as to economize transport charges. At Doniambo the furnaces were blown in last July for the fusion of hydrosilicate ores into mattes containing 45 per cent. of nickel. The minimum value of the ores thus treated is fixed at 5½ per cent., and each of the six furnaces passes about 15 tons per twenty-four hours. Two others are in course of construction, and the works will then attain a capacity of 35,000 tons of matte annually. At Tao the smelters are run by hydro-electric energy, and it is proposed to harness the whole hydraulic power of the river Tao, which it is calculated will aggregate 10,000 h.p. At Thio the Nickel Company are erecting a large smelting establishment to reduce their ores to matte and send them to their works in Europe for refining. The Chrome Company intend to capture the waters of the river Yate, estimated to furnish 25,000 h.p., with the object of reducing their ores to ferro-nickel and ferro-chrome. These works will involve an outlay of over £200,000; this company produced 40,000 tons [4]of 6.30 per cent. nickel ore in 1910.

Nickel ores of the Sudbury type are reported from Cape Colony, South Africa. The deposits are thus described by the *Mining Magazine* (London, Eng.) for May, 1912:—

> The *South African Mining Journal* for March 9 contains an account by A. L. Du Toit, extracted from government reports, of the copper-nickel deposits at Mount Ayliff, in the Insizwa range, East Griqualand. This district is about 100 miles southwest of Pietermaritzburg in Natal, and 50 miles from the east coast of the Cape province. The occurrence of copper ore in this district has been known for twenty years, and a limited amount of prospecting has been done, but without any satisfactory results. The examination of the district by the Cape Geological Survey has given a new impetus, and the account of the geology and ore deposits is of considerable interest. The strata are bluish shales, flagstones, and thin sandstones, belonging to the Beaufort series of the Karroo system, and lying nearly horizontal. These beds have been penetrated by numerous intrusions of igneous rocks in the shape of sheets and dikes. Most of the igneous rocks may be classed as dolerite, but the great sheet of the Insizwa range and of the adjoining peaks and ridges partakes more of the nature of gabbro. The metamorphism of the strata caused by the igneous rocks is more pronounced than in the Karroo and Stormberg districts further west. The copper-nickel ores are found mostly at the contact of the gabbro and the altered sedimentaries. They are also found to a small extent as impregnations of the sedimentaries, but are more abundant in, and sometimes restricted to, the igneous rocks, of which they appear to have been an original constituent. The mode of occurrence is somewhat similar to that of the copper-nickel deposits at Sudbury, Ontario, and in Norway. Owing to the infrequent exposure

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[3] Echo des Mines, April 18, 1912, quoted in Eng. and Mg. Journal, New York, May 4, 1912.

[4] See the Mining Journal (London, Eng.), December 23, 1911.

of the base of the gabbro, the evidence of the presence of ore can only be obtained by sinking, and this has been undertaken when the rocks are stained with carbonate of copper or with silicate of nickel, in the presence of limonite. The three chief minerals found in the lodes are pyrrhotite, chalcopyrite and pentlandite, that is, a sulphide of nickel and copper of variable composition. The ores can be generally separated into two groups, one consisting chiefly of chalcopyrite, and the other richer in pyrrhotite and pentlandite, but the character of the ore varies so much, and the minerals are so finely divided, that it is doubtful whether the minerals preponderating in nickel and copper respectively could be separated mechanically in ordinary ore-dressing practice. Bornite is also found in thin layers along joints in altered sandstone close to the contact. Niccolite, the arsenide of nickel, has been found in thin veins, in the foot-wall in one of the workings. Platinum has been detected in varying amounts, and is considered to be in the form of sperrylite, the arsenide of platinum. In one case it has been found in a sample of ilmenite. The assays of a large number of samples have shown the copper to average 4 per cent., the nickel, 3.8 per cent., and the platinum, 2½ dwt. per ton. The Cape government is affording every facility for further prospecting of this deposit.

The last five years of the nickel-copper mining industry are summarized in the following table:—

Table No IX.—Nickel-Copper Mining, 1907 to 1911

Schedule.		1907	1908	1909	1910	1911
Ore raised	tons	351,916	409,551	451,892	652.392	612,511
Ore smelted	"	359,076	360,180	462,336	628,947	610,788
Bessemer matte produced	"	22,041	21.197	25,815	35,033	32,607
Nickel contents	"	10,602	9,563	13,111	18,636	17,049
Copper contents	"	7,003	7,501	7,873	9,630	8,966
Value of Nickel	$	2,270,442	1,866,059	2,790,798	4,005,961	3,661,474
Value of Copper	$	1,020,913	1,062,680	1,122,219	1,374,103	1,281.118
Wages paid	$	1,278,694	1.286,265	1,234.904	1,698,184	1,830.526
Men employed	No.	1,660	1,680	1,796	2.156	2.439

International Nickel Company

The following information is extracted from the ninth annual report of the International Nickel Company, being for the twelve months ending March 31, 1911. The company's capital stock issued and outstanding was as follows:—common stock, $11,582,606; preferred stock, 6 per cent. non-cumulative, $8,912,626; total, $20,495,252. The net bonded debt was $8,475,153. Earnings of constituent companies, after charging manufacturing and selling expenses and repairs, amounted to $5,256,938. Deducting administrative and head office expenses, $228,064, the net income was $5,028,873. After making provision for the following: Depreciation of Plants, $454,319; Mineral Exhaustion, $151,603; Bond Sinking Fund, $192,000, and Interest on Bonded Debt, the profits for the year were shown to be $3,775,600, out of which were paid dividends on preferred stock of $534,748, and on common stock, $808,778, the remainder, $2,432,073, being transferred to the balance sheet. Common stock amounting to $2,670,000 was issued at par to both preferred and common stockholders to the extent of 15 per cent. of their then holdings. The rate of dividend on the preferred stock was 6 per cent., and on the common 7 per cent., plus 25 per cent., or 32 per cent. in all. President A. Monell remarks:—

> The demands for the company's products for the fiscal year just closed was the largest in the company's history, indicating that the increase of 1909 over previous years was well grounded. The growth of the motor vehicle business, both for pleasure and transportation, and the wise policy of the makers to use a superior grade of steel, has an important bearing on these results. A study of this transportation business leads us to believe that it has a vast field for further expansion. Experience has proved that the best available material is the cheapest type of construction for efficient and continuous service. We are still developing the Movel Metal business. During the year satisfactory arrangements have been made to supply the trade with castings, rods and sheets. We are still continuing our policy of plant improvement and development at Copper Cliff upon every possible opportunity.

Copper

The whole of the copper produced in 1911, with a trifling exception, came from the nickel-copper mines of the Sudbury district. This exception consisted of some 50 tons of ore raised from a prospect in the township of Lebel, east of the T. & N. O. railway, owned by Messrs. Ogilvie and McKinnon, now the Dane Mining Company. The ore was shipped to the American Smelting and Refining Company, Perth Amboy, N.J. The deposit carries small values in gold and silver.

None of the sulphide mines on the north shore of lake Huron were in operation. Bruce Mines, owned by Messrs. Leonard and Longwell, has been shut down, and the machinery is offered for sale. The silicious nature of the gangue makes the ore undesirable for smelting, and the copper contents are low. A discovery of chalcopyrite of good quality was reported from the township of Gould on the Mississaga river.

Iron Ore

Iron ore to the amount of 175,631 tons was shipped in 1911 from four mines, Helen, Atikokan, Moose Mountain and Belmont, the last-named sending out a few tons only. Of the consignments, 137,377 tons were hematite, and 38,254 tons magnetite. From the Moose Mountain mine 5,294 tons were shipped to Ashland, Kentucky, and Buffalo, N.Y., and from the Cordova mine 126 tons to the Buffalo Union Furnace Company, Buffalo, N.Y. The remainder of the shipments went to blast furnaces in the Province. The number of men employed in the mines was 685, and the amount of wages paid $348,062. The Wilbur mine, owned by the Hawthorne Silver and Iron Mines, raised a quantity of ore, but made no shipments.

At the Magpie mine, Michipicoten district, the property of the Lake Superior Corporation, a plant is being installed to prepare the sideritic ore for smelting. The process consists in roasting, with the view of eliminating the sulphur and carbonic acid contents. A Gröndal magnetic concentration plant is well advanced towards completion at Moose Mountain, where portions of the ore body are too low in metallic iron contents to be suitable for smelting in their natural condition.

Iron ore is reported from the township of Miscampbell, Rainy River district, but nothing definite is yet known as to the extent or value of the deposits.

Pig Iron and Steel

There are now nine blast furnaces in Ontario for the production of pig iron. The Algoma Steel Company at Sault Ste. Marie has three, the Canada Iron Corporation, Midland, two; the Steel Company of Canada, Hamilton, two, and the Atikokan Iron Company, Port Arthur, and the Standard Chemical Company, Deseronto, one each. In all, these plants turned out 526,610 tons of pig iron, valued at $7,716,314, an average of $14.65 per ton. In 1910 eight furnaces produced 447,351 tons of pig iron, worth $6,975,418. At Sault Ste. Marie the whole, and at Hamilton a part, of the pig iron product is converted into steel, the former making Bessemer and open-hearth steel, and the latter basic open-hearth. Much the greater part of the steel output of the Algoma Steel Company is rolled into "standard tee" rails, of which the production last year was 243,703 tons, the remainder, 24,617 tons, being in the form of merchant bars, tie plates, angle splice bars, light rails, bolts and nuts.

The supplies of ore for the use of blast furnaces in Ontario continue to come mainly from the United States. The product of the Helen and Atikokan mines went to the smelters at Sault Ste. Marie and Port Arthur respectively, and part of the output at Moose Mountain was shipped to Hamilton; but the entire quantity of Ontario ore actually charged into the furnaces was only 67,631 tons, out of a total of 916,445 tons smelted, or a trifle over 7 per cent.

The figures in the following table cover the sixteen years which have elapsed since the iron smelting industry of Ontario awoke from its long sleep in 1896, and they show that the proportion of iron ore supplied to the furnaces from mines situated within the boundaries of the Province is not increasing. Only once—in 1901—did it amount to more than one-half, and for the whole period did not reach one-quarter, declining to 7.3 per cent. in 1911. Of the whole quantity of iron ore raised from the mines of Ontario during this time, 2,462,807 tons, a little over one-half went to furnaces in the Province, and the remainder was exported. This fact goes to show that even if iron ore of domestic origin were being produced more freely than it is, a considerable proportion would probably find its way to the other side of the border. Blast furnaces require a mixture of ores for the proper regulation of the charge, or to produce iron of a particular quality, hence part of the ore exported from Ontario to the United States may be regarded as in reality exchanged for ores of composition better suited to the purpose in hand. In the tremendous deposits of Minnesota and Michigan, with their highly developed system of water transportation, iron-masters in the lake and other regions of the east have a variety of choice and an assured continuity of supplies which the mines of Ontario do not as yet afford. So far, the extensive iron formation rocks which characterize many parts of northern and northwestern Ontario have provided a few large bodies of workable ores, among them the Helen, Moose Mountain, Atikokan and Magpie, and in many other localities there is reason to believe that further exploration will be similarly rewarded. There are numerous deposits of banded magnetite and other types of silicious ore which at some future time will undoubtedly be utilized by suitable processes of concentration, but which under present conditions must remain dormant.

In the fact that the raising of iron ore has lagged behind the making of pig iron and steel, Ontario is typical of the Dominion of Canada as a whole. Out of a total Canadian production of pig iron in 1911 of 917,535 tons, no less than 875,349 tons, or 95 per cent., was smelted from imported ore.

Table X.—Iron Ore Produced and Smelted in Ontario

Year.	Produced in Ontario.	Ore smelted in Ontario.			Proportion Ontario ore smelted
		Ontario Ore.	Foreign Ore.	Total.	
	Tons	Tons.	Tons.	Tons.	Per cent.
1896		15,270	35,868	51,138	29.8
1897	2,770	2,770	34,722	37,492	7.3
1898	27,409	20,958	56,055	77,013	27.2
1899	16,911	24,494	85,542	110,036	22.2
1900	90,302	22,887	77,805	100,692	22.7
1901	273,538	109,109	85,401	194,510	56.0
1902	359,288	92,883	94,079	186,962	49.6
1903	208,154	48,092	103,137	151,229	31.7
1904	53,253	50,423	173,182	223,605	22.5
1905	211,597	91,960	383,459	475,419	19.3
1906	128,049	101,569	396,463	498,032	20
1907	205,295	120,156	388,727	508,883	23.6
1908	216,177	170,215	342,747	512,962	33.1
1909	263,777	220,307	543,544	763,851	28.7
1910	230,656	143,284	679,890	823,174	17.4
1911	175,631	67,631	848,814	916,445	7.3
Total	2,462,807	1,302,008	4,329,435	5,631,443	Av. 23.1

The figures show the business of iron ore smelting to have experienced a steady growth during the period covered by the Table. The blast furnace established at Hamilton in 1896 began the production. Deseronto followed suit in 1898, Midland in 1900 Sault Ste. Marie in 1904, and Port Arthur in 1907. The Hamilton, Midland and Sault Ste. Marie plants have all increased their capacity since their establishment, there being now a total of nine furnaces in operation. Shipments from the Helen mine began in 1900, and this property has furnished the greater part of the production of ore since that time.

For the year 1911 the extent of the blast furnace and steel making operations is shown by the following figures:—

Ontario ore smelted	tons	67,631
Foreign ore smelted	tons	848,814
Scale and mill cinder	tons	18,476
Limestone for flux	tons	275,628
Coke for fuel	tons	577,388

Value of ditto		$2,367,704
Charcoal for fuel	bush.	1,666,897
Value of ditto		$158,354
Pig iron product	tons	526,610
Value of ditto		$7,716,314
Steel product	tons	361,581
Value of ditto		$9,505,013
Workmen employed	No.	3,633
Wages paid		$2,927,573

The Electro Metals, Limited, Welland, have developed a considerable business in the manufacture of ferro-silicon produced in electric furnaces, of which there are seven. The silica is supplied by flint, sandstone and sand of suitable composition, and is fused with iron ore. The ferro-silicon contains about 50 per cent. silicon. Experimental quantities of ferro-titanium (10 per cent. titanium) were also made.

Table XII., which follows, gives particulars of the manufacture of pig iron and steel in Ontario during the five year period beginning with 1907:—

Table XI.—Production Iron and Steel, 1907 to 1911

Schedule.		1907.	1908.	1909.	1910.	1911.
Ontario ore smelted	tons	120,156	170,215	220,307	143,284	67,631
Foreign ore smelted	"	388,727	342,747	543,544	678,890	848,814
Limestone for flux	"	171,037	179,741	226,991	248,750	275.628
Coke	"	326,937	322,817	436,707	471,493	577,388
Charcoal	bush.	1,849	....	973,413	1,133,419	1,666,897
Pig iron	tons	286,216	271,656	407,013	417,351	526,610
Value of pig iron	$	4,716,857	4,390,839	6,301,528	6,975,418	7,716,314
Steel	tons	237,855	172,108	296,031	331,321	361,581
Value of steel	$	4,168,127	4,397,082	6,759,960	7,855,407	9,505,013

Construction Materials

Building or construction materials, including bricks of all kinds, lime, stone and cement, were produced to a greater value in 1911 than in the previous year by upwards of a million dollars. The only article in the list showing a decrease was lime, of which the returns showed $72,191 worth less to have been made than in 1910. The building trade was active last year, particularly in the cities and larger towns, and the demand for bricks, stone and cement was good. It is even probable that in some cases building operations were curtailed because of the difficulty in procuring the necessary materials.

Brick

Common brick to the number of 354,546 M. were made in 1911, having a value of $2,801,971, as compared with 304,988 M. in the year previous, valued at $2,374,287. The average price per M. works out at $7.90, as against $7.78 in 1910. For many years the cost of brick as reported by the brickmakers to the Bureau of Mines has been advancing. In 1901 the average price per M. was $5.73, and it rose successively to $6.41 in 1902, $6.78 in 1903, $7.15 in 1904, and $7.75 in 1905. Here a check was interposed, and the price fell back in 1906 to $7.19, but regained in 1907 almost all the lost ground, advancing to $7.70. It receded in 1908 to $7.09, but went up again in 1909 to $7.78, maintained that figure for 1910, and in 1911 reached the highest point yet at $7.90. Beyond doubt the increase has been largely due to the higher wages paid for labor, which is the chief element in the cost, but partly also, it may be, to the greater demand, the annual manufacture having risen from 259,265 M. in 1901 to 354,546 M. in 1911. Builders say that of late years better methods have been in use for manipulating the clay and burning the brick, with the result that the quality of the product has been considerably improved. There is also a greater variety to be had, in color and form, enabling effects to be obtained in house-building which were previously impossible.

Of pressed brick, the number made last year was 52,763,914, an increase over 1910 of 8,559,619. The value rose from $458,596 to $564,630, the average value being $10.70 per M., as compared with $10.37 in 1910. Shale from the Hudson River and Medina formations is used as raw material for pressed, or rather re-pressed, brick.

The number of brickyards is large, and they are to be found in practically all parts of the Province, especially in the older districts. In the newer settlements, where timber is plentiful, wooden buildings are the rule, as being the cheapest, but in the hot summers, and even at other seasons of the year, villages or towns built of wood are subjected to the constant menace of destruction by fire. The newer towns of the north, Cobalt, Haileybury, Elk Lake, Gowganda, Cochrane, Porcupine, and the like, have all been visited by conflagrations, sometimes due to burning forests and sometimes to causes within the towns themselves; and heavy loss of property, and occasionally loss of life, has been the result. In the absence of any other available material, re-building operations have again made use of wood, so that until suitable deposits of clay can be located and brickyards opened, it is difficult for these frontier communities to ensure themselves against the recurring ravages of fire. In some parts of the Province stone is abundant and is preferred to brick, but in general the latter is the material of which not only the dwellings, but also the business places and factories of older Ontario are built. The clay in certain localities and of deposits of a particular kind burns white, but the great bulk of the brick used for construction purposes are of some shade of red.

Paving brick for street-making was manufactured in 1911 to the number of 4,522,400, valued at $86,685. This compares with 3,799,025 made in 1910, worth $70,648. The price per M. rose from $18.59 in 1910 to $19.16 last year.

Of all classes of brick—common, pressed and paving—the manufacture last year had a total value of $3,453,286, as against $2,903,531 in 1910. Including drain tile, dealt with below, which are usually made in the same yards as brick, the number of men employed in the industry was 3,654, to whom were paid wages amounting to $1,592,020. The average earnings per man employed were, therefore, $435, as compared with $400 in 1910 and $303 for 1909, clearly pointing to increased remuneration and a longer working season.

Lime and Stone

The quantity of lime turned out by the kilns of Ontario last year, according to returns made to the Bureau, was less than in 1910, being 2,469,773 bushels, worth $402,340, as against 2,889,235 bushels, valued at $474,531 in the previous year. The average price per bushel in 1911 was 16.2 cents, as against 16.4 cents in 1910. Limestone is abundant, and lime is consequently easily procurable in older Ontario, but less easily so in the northern districts, where the geological formations are largely of a different character. A feature of the new Central Prison at Guelph is the employment of convict labor in quarrying stone and burning lime, the hydrated variety of which is also made.

Building and crushed stone, which are grouped together for statistical purposes, had a production last year valued at $892,627, or an increase of $131,501 over 1910. The uses to which this material are put are many and varied. Of the large-sized stone, much of it goes into buildings, the cut or dressed stone for facings or outside walls, the commoner kinds into inside walls and foundations; and part is used for bridge abutments, piers, break-waters and other large and heavy works. The crushed product is used largely for roads and pavements, and when of suitable composition, for blast furnace flux. There was a considerable production of granite in 1911 by Messrs. David J. Gordon and Sons, Gananoque.

The marble quarries near Bancroft, in the county of Hastings, are producing material which in color, beauty and variety of markings, and size of slabs, compares favorably with almost any other marble on the market. Among the buildings in which it has been used for interior decorations is the new Standard Bank building on King Street West, Toronto. The veinings and shades of color are striking, yet pleasing in effect. A marble deposit is also being opened up at Marble Bluff, in the Township of Darling, Lanark county, by the North Lanark Marble and Granite Quarries, Limited, of St. Catharines. The material is serpentine, of a handsome green color.

It may not be out of place to note here that while investigating the Pre-Cambrian geology of southeastern Ontario, Prof. W. G. Miller, Provincial Geologist, and his assistant, Mr. C. W. Knight, located an area of trap rock near Havelock Station on the Canadian Pacific Railway. Trap is an ideal material for road-making, being hard and very tough. The engineer for the system of good roads under construction in the neighborhood of Toronto, Mr. E. A. James, being on the outlook for a quarry within convenient distance of Toronto from which to obtain stone for use on these roads, had his attention directed by Mr. Knight to this particular locality. It is understood that on examination, Mr. James found that this occurrence of trap practically solved the problem of providing suitable material. The quarry will be within 100 miles of Toronto, and could supply rock not only for that city, but also for other cities and towns within an economical shipping radius. The city of Cleveland, Ohio, whose boulevards are famous among American cities, has for years been drawing supplies of similar trap rock from near Bruce Mines, Ontario. The foregoing is an instance of how "practical" results are not infrequently the outcome of work undertaken primarily for "scientific" purposes.

Portland Cement

The manufacture of Portland cement in Ontario is now largely in the hands of the Canada Cement Company, Limited, whose plants at Belleville (2), Marlbank, Lakefield, Port Colborne and Shallow Lake produced two-thirds of the entire quantity made last year. The other plants are those of the National Portland Cement Company, Durham; the Imperial Cement Company, Owen Sound; the Ontario Portland Cement Company, Blue Lake; the Maple Leaf Portland Cement Company, Atwood; the Superior Portland Cement Company, Orangeville; the Hanover Portland Cement Company, Hanover; the Kirkfield Portland Cement Company, Raven Lake; the Sun Portland Cement Company, Owen Sound, and the Crown Portland Cement Company, Wiarton. The production in all was 3,010,849 barrels, valued at the works at $3,640,642, or $1.209 per barrel. In 1910 the output was 2,471,837 barrels, worth $3,144,343, or $1.273 per barrel.

The constantly growing use of Portland cement for a great variety of purposes has naturally stimulated the production in Ontario, where the raw materials are abundant. The tendency noted in previous reports to employ limestone rock instead of marl for the necessary carbonate of lime continues to be manifested. The largest producers are those plants which use rock; in fact, not far from one-half of the total out-put last year was made from limestone. Beds of marl, large though they may occasionally be, are of small cubical contents compared with strata of rock, scores, perhaps hundreds, of feet in thickness, and extending over many acres in area. Economy in transportation and handling of material are therefore possible, of which ordinary marl deposits do not permit. The product in the one case seems to be as good as in the other, but naturally that process which can produce the article more cheaply will in the end obtain mastery of the field.

The quantity of cement in stock at the beginning of the year was 581,033 barrels, and at the close 543,611 barrels. The number of men employed in the factories was 1,471, who earned in wages $898,256.

At one time a considerable business was done in the manufacture of so-called "natural rock" cement, which was made by crushing and grinding limestone of suitable composition without the addition of clay. It sold for a smaller price per barrel than the Portland variety, but for a variety of reasons it waned in the popular esteem as Portland cement was introduced and began to be made in quantity, and its manufacture in this Province has now entirely ceased.

The following table shows how rapidly the production of Portland cement has increased in this Province since 1891, when it first began:—

Table XII.—Production of Portland Cement, 1891 to 1911.

Year.	Barrels.	Value.
		$
1891	2,033	5,082
1892	20,247	47,417
1893	31,924	63,848
1894	30,580	61,060
1895	58,699	114,332
1896	77,760	138,230
1897	96,825	170,302
1898	153,348	302,096
1899	222,550	444,228
1900	306,726	598 021
1901	350,660	563,255
1902	522,899	916,221
1903	695,260	1,182,799
1904	880,871	1,239,971
1905	1,254,360	1.783,451
1906	1.598,815	2,381,014
1907	1,853,692	2.777.478
1908	2,022,877	2,417,769
1909	2,303,263	2.897.348
1910	2,471,837	3.144,343
1911	3,010,849	3,640,642
Total	17,966,075	24,888,907

It will be seen from the table that every successive year has seen a larger output than the year before, and that the tendency towards increase is still strong. Concurrently, there has been a steady decrease in the price per barrel at which the output is valued. Thus, in 1891, the average was $2.499 per barrel. In 1896 it had fallen to $1.777; in 1901 to $1.606; in 1906 to $1.495, and in 1911 to $1.209.

Other Clay Products

The practice of tile draining is now recognized as a constituent of good farming, and assistance is provided by the Government of Ontario both to township municipalities who may wish to borrow money for loaning to farmers for putting in tile drains, and to the individual farmers themselves. In the former case money is advanced at four per cent. interest to the township councils, who collect the principal and interest along with the ordinary taxes from those to whom the money is advanced. In the latter, experts are sent out by the Ontario Agricultural College, who lay out plans of farm drainage and give instruction in the proper methods of installing the tiles. The expense of this work to the farmer benefited is nominal, but of course the cost of the tiles and of laying them in the ground is borne by him. The manufacture of tile is carried on along with brickmaking in a number of the yards situated in the agricultural districts. Last year the number of tile made was 21,630,000, worth $349,545, as compared with 21,028,000, valued at $318,456 in 1910.

Sewer pipe of good quality is made in three factories, belonging respectively to the Dominion Sewer Pipe Company, Swansea, the Ontario Sewer Pipe Company, Mimico, and the Hamilton and Toronto Sewer Pipe Company, Hamilton. The united output of these plants for 1911 had a value of $410,064, as against $357,087 in 1910.

Arsenic

The proportion of arsenic contained in the ore and concentrates shipped from the mines of the Cobalt district is assumed for statistical purposes to be 14.28 per cent.,[5] and on this basis the arsenic contents of the shipments for 1911 was 3,806 tons. There were recovered from the product of Cobalt mines by the several refining works in Ontario 2,117 tons of white arsenic, the actual shipments being somewhat greater, namely, 2,170 tons. This is equivalent to 1,605 tons metallic arsenic. This leaves 2,201 tons unaccounted for, so far as the statistics of this Bureau are concerned. The bulk of it went to the smelting works in the United States and elsewhere along with the ore and concentrates in which it was contained. A portion was no doubt saved in these works during the process of recovering the silver, but it is impossible to say how much. Another, perhaps the greater portion—that contained in the ores of lower grade—went to waste. There are other sources of arsenic in Ontario, notably the mispickel deposits of Hastings county, some of which carry gold as well, but none of these are being worked at the present time.

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[5] See 20th Rep. B.M., 1911, page 17 et. seq.

The value accredited to the arsenic output, $74,609, is that received by the refining companies for their shipments of white arsenic during the year, nothing being allowed for the contents of exported ores.

Iron Pyrites

Of iron pyrites there were mined and shipped (or used) last year 43,629 tons, valued at $118,457, or at the rate of $2.71 per ton. The production in 1910 was 33,812 tons of ore, worth $98,353. Four mines contributed to the output, those of the Northern Pyrites Company, near Lake Minnietakie, the Nichols Chemical Company at Sulphide in Hastings county, the Lake Superior Power Company (Helen iron mine) and the Canadian Sulphur Ore Company, also in the county of Hastings. A little was also shipped by the Buffalo-Brockville Mining Company from a deposit near the town of Brockville.

The iron pyrites resources of this Province are of considerable extent and value. Some of the largest deposits have not yet been worked in a commercial way, notably those at Goudreau lake, in the district of Michipicoten. The chief use of iron pyrites is in the manufacture of sulphuric acid, for which purpose the sulphur contents are recovered by roasting. The residues are now in some cases utilized as iron ore, provided a sufficiently complete elimination of the sulphur is obtained.

An acid-making plant is operated by the Nichols Chemical Company in connection with their mine at Sulphide, and the ore raised by that company was used for the production of acid. The company also buys the ore mined by the owners of other deposits in the neighborhood.

The Northern Pyrites Company began shipping from the Vermilion mine on Lake Minnietakie last year, and owing to the construction of the Grand Trunk Pacific railway, are now in a position to market a large output.

The growth of the iron pyrites industry during the last five years is shown in the following table:—

Table XIII—Production of Iron Pyrites, 1907 to 1911

Schedule.	1907.	1908.	1909.	1910.	1911
Pyrites shipped..........tons	15,755	20,970	28,946	33,812	43,629
Value of do.......... $	51,842	69,980	78,170	98 353	118,457
Workmen employed.......... No.	137	132	132	227	172(*a*)
Wages paid.......... $	75,365	95,740	104,687	117,191	114,655(*a*)

(*a*) Does not include Helen mine, the statistics for which are comprised in those for Iron Ore.

Mica

The producers of mica last year were few in number, being the Loughborough Mining Company, Sydenham, the Dominion Improvement and Development Company, Perth, W. L. McLaren, Perth, and Kent Bros., Kingston. The total output of rough-cobbed mica was 322 tons, valued at $43,058, as compared with 543 tons, worth $85,294 in 1910. One or two other individuals and firms were prospecting their properties, but made no shipments.

The amber mica (phlogopite) of Ontario and Quebec is recognized as being the best on the market, equalling the white mica (muscovite) of India and elsewhere in its power of resistance to the electrical current, and being superior in flexibility and capacity for thin-splitting. Its value per pound depends upon the sizes which can be obtained from the product, the larger pieces being worth many times per pound those of inferior size. The smaller pieces can, however, be built up by the use of shellac into "micanite," which answers the purpose served by the larger sizes. Black mica (biotite) is sometimes mixed in small proportions with the amber variety in making micanite.

Salt

The brine wells of the south-western peninsula last year yielded 88,689 tons of salt, the value of which was $430,835. In 1910 the output was 84,071 tons, worth $414,978. The industry gave employment to 216 workmen, whose wages amounted to $121,477. There is, of course, a steady demand for this staple article, mainly for preservative purposes connected with food products, etc., but this demand is easily satisfied and does not seem to be increasing. Its requirements are small in comparison with the abundant supplies of raw material, which is present in enormous quantities. Salt constitutes the basis of a number of products of great importance in the industrial arts, connected with one or other of the elements composing it. From chlorine may be built up hydrochloric acid, bleaching powder and a variety of other articles, while the compounds of sodium, such as carbonate and bi-carbonate of soda, sodium nitrate, etc., play perhaps even a larger part in manufactures. A plant for the manufacture of caustic soda and bleaching powder from salt was established at Sandwich by the Canadian Salt Company and began operations during the last week of 1911. Some inquiry has also been made on behalf of a European firm of explosives manufacturers as to the availability of salt supplies required for the sodium nitrate used in making their product, which is finding a market in the mines at Cobalt.

About one-half of the salt made in Ontario is produced by the Canadian Salt Company, whose plants are at Windsor and Sandwich. Other makers are the Dominion Salt Company, Sarnia; Western Canada Flour Mills Company, Goderich; John Ransford, Stapleton; Ontario People's Salt and Soda Company, Kincardine; Gray, Young and Sparling, Wingham; the Western Salt Company, Mooretown; Parkhill Salt Company, Parkhill; the Elarton Salt Works Company, Warwick; Exeter Salt Works Company, Exeter. The following firms were not working in 1911: Carter and Kittermaster, Mooretown; George McEwen, Hensall; John Ransford, Brussels.

The workmen employed at the salt wells and works numbered 216, and their wages amounted to $121,477.

Petroleum

The production of petroleum in Ontario continues to decline. The quantity of crude oil yielded by the wells of Lambton and Kent counties and those in the smaller outlying pools amounted to 10,102,081 imperial gallons, as compared with 11,004,357 gallons in 1910. These figures are supplied by the Department of Trade and Commerce, Ottawa, and are compiled from the returns made by the claimants for the bounty of 1½ cents per imperial gallon paid by the Government of Canada on crude petroleum produced in Canada. Statistics of production by districts are kindly furnished by Mr. W. J. Harvey, Supervisor of Crude Petroleum Bounties, Petrolia, as follows:—

	Bbl	Gal.
Lambton	184,450	..
Tilbury	48,707	3
Bothwell	35,243	28
Dutton	6,731	26
Onondaga	13,501	4
Total	288,633	26

There was only one change in price during the year, namely, an advance on September 15th from $1.22 to $1.24 per barrel. Adding to this the bounty of 52½ cents per barrel, the average return for the year to the producer was $1.75 per barrel. In computing the value for the statistical tables of this report the bounty is of course not included.

The following table shows the output of the several fields or pools for the five years ending 31st December, 1911:—

Table XIV.—Petroleum Production by Districts, 1907 to 1911

Field.	1907.	1908.	1909.	1910.	1911.
	bbl.	bbl.	bbl.	bbl.	bbl.
Lambton	301,212	265,368	243,123	205,456	184,450
Tilbury and Romney	411,588	201,283	124,003	63,058	48,707
Bothwell	42,727	39,228	38,092	36,999	35,243
Leamington	6,133	9,334	5,929	141	....
Dutton	14,977	13,743	9,513	7,752	6,731
Thamesville	237	....	....	....	....
Onondaga (Brant Co.)	....	....	....	1,005	13,501
Total	779,876	528,959	420,660	314,410	288,633

The falling-off in the old fields is apparent from the table. Had it not been for the production from Onondaga, in the county of Brant, a pool which came in in 1910, the decrease would have been still more noticeable. It is apparent that the future of petroleum production in Ontario very largely depends upon the discovery of new oil-bearing territory, and there is ground for believing that fields yet unknown await the "wild-catter." In March, 1912, petroleum was struck at Milton, in the county of Halton. Mr. C. W. Knight, Assistant Provincial Geologist, furnishes the following note after visiting the spot.

On March 28th, 1912, the writer visited the plant of Brandon's Pressed Brick and Oil Company, which lies on the outskirts of the town of Milton. About three weeks previous to this date oil had been struck in a well on this property, a hole having been drilled about 75 yards from the pit in which the Medina shale is being dug for the brick works.

In the absence from town of Mr. Brandon, the President of the Company, the drill-man refused to give me details of the log of the well. He stated, however, in a general way, that it had been drilled about 1,500 feet, and that Medina, Hudson River, Utica and Trenton had been met with, the well having gone about 300 feet into the Trenton.

In his report on clays, Mr. M. B. Baker states that the red shales exposed on the surface at Milton belong to the Medina formation.

One Mr. Martin, interested in the brick company and oil well, stated that about 40 barrels had been obtained from the well, all of which was pumped, and he thought it would average about four or five barrels a day. The drill-man states that the oil has a specific gravity of about 39 B. I obtained a large and a small bottle of the oil for sample.

After firing, the flow of the oil was said to have greatly diminished, but the company has decided to continue sinking, and also to drill another well some 50 yards or more from the present one. About $3,000 have already been expended on the work.

More crude petroleum was treated at the refining works than in any previous year. There are two refineries, one owned by the Imperial Oil Company, Sarnia, and the other by the Canadian Oil Companies, Limited, Petrolea. Much of the larger part was, as for many years it has been, imported from the United States. The total quantity distilled was 38,632,504 imperial gallons, of which 28,244,913 gallons was American, and 10,387,591 gallons Ontario crude. The table which follows exhibits the course of the petroleum refining industry in Ontario for the last five years:—

Table XV.—Petroleum and Petroleum Products, 1907 to 1911

Schedule.		1907.	1908.	1909.	1910.	1911.
Crude produced	Imp. gal.	27,621,851	18,479,547	14,723,105	11,001,357	10,102,081
Crude distilled	"	31,961,706	34,675,120	35,530,918	36,171,032	38,632,504
Value crude produced	$	1,049,631	703,773	559,478	368,153	353,573
Value distilled products	"	2,568,464	2,347,680	2,501,384	2,511,368	2,294,396
Illuminating oil	Imp. gal.	18,319,233	17,604,920	17,902,254	18,983,357	20,240,523
Lubricating oil	"	3,931,767	3,384,940	3,856,778	4,169,038	4,729,257
Benzine and naphtha	"	4,132,239	3,667,997	3,930,691	4,297,615	4,179,575
Gas and fuel oils and tar	"	5,632,608	4,461,186	4,687,588	5,876,498	4,847,124
Paraffin wax and candles	lb.	5,132,394	5,400,003	7,092,278	5,179,391	5,267,485
Workmen employed	No.	435	430	436	428	511
Wages paid	$	265,316	217,829	261,014	280,485	311,851

Below is reproduced a letter from Mr. Charles Jenkins, of Petrolea, regarding the petroleum situation in this Province. As Mr. Jenkins is one of the oldest and most experienced oil operators in Ontario, his views are entitled to much weight.

At the end of the year 1911, the future of the petroleum producing business in the Province of Ontario is somewhat problematical. For some years the production has been declining. It is noteworthy that the oldest producing districts, Oil Springs and Petrolea, in the county of Lambton, and Bothwell, in the county of Kent, still remain at the head of the producing districts, although after an average of forty years continued pumping, the volume of their production is reduced.

To estimate the possibilities we have to consider the conditions. The Oil Springs and Bothwell crudes are a little lighter in gravity than the Petrolea crude, although similar in other respects. They are all produced from the Corniferous rock, Lower Devonian division of the Upper Paleozoic period. The rock is porous, and has been a great storehouse for crude petroleum. The crude in the Tilbury and Leamington regions comes from the Guelph strata, immediately below the Onondaga in the Lower Paleozoic period. So far it has come only in veins, and closely allied with it is the region of the natural gas production. A sample of the rock from which it is taken as compared with that of Bothwell is like the ordinary limestone for building compared with a piece of maple sugar. This accounts for the rapid decline of these later discovered territories. The Onondaga field has so far failed to make a large contribution to the production. Its oil is found in the White Medina strata, an earlier formation than the Guelph, contiguous to gas-producing area.

The oldest rock known to be oil producing is the Trenton limestone, also in the Lower Paleozoic, but so far drilling has failed to discover any paying production in this rock in Ontario. The Cincinnati anticlinal in this formation, runs up through Ohio, where it is 1,000 to 2,000 feet deep, and finally gets to the surface at the Manitoulin islands. Oil shows in the rock there have several times stimulated efforts to prospect, but without success as paying propositions.

A variety of small fields have been discovered and pumped in the past. The largest of them at present is in Dutton, another is in Euphemia township, and there is yet another in Dawn township, and shows have been seen in many places, but the conditions for paying workings were not there. For a permanent field a certain thickness of porous or oil rock is required which must be overlaid with impervious strata, usually shale.

The discovery of an oil field is very often a matter of accident. It was drilling for water that led to the discovery of the Ohio field.

The Petrolea district is the largest in area in Ontario, so far extending about ten miles, north-west to south-east, by an average of three miles north to south, but the other fields have been of small area, and who can say where other fields may be discovered ? We have from the Trenton to the Corniferous to explore in, and a discovery of a new field may be made at any time.

All the oil produced in Ontario is paraffin base. These geological limits appear to preclude the discovery of any asphaltic base oil in Ontario, as from the results of drilling it would appear that asphaltic base crude is not produced anywhere below the Carboniferous period, but in or above it, and Ontario as far as explored geologically, shows older formations. The most of the large production in the United States recently has been of this kind of oil.

The outlook for increased production, therefore, entirely depends upon the chances of finding new fields with the proper conditions. In the old fields, the rate of decline is not so great as it was, and the extent of the probable area in western Ontario in which petroleum may be found forbids us to consider that petroleum production in Ontario is an exhausted industry.

Mr. Jenkins adds the following note to make clear the distinction between oils having a paraffin and those having an asphalt base.

The difference between them is that the molecule of the paraffin has two atoms of hydrogen in it more than the asphaltic, thus:—

Paraffin . . . . C_6H_{14}
Asphaltic . . . . C_6H_{12}

paraffin are more valuable than those of the asphaltic, the chief uses of the latter so far
In the early stages of the process of distillation, their behavior is not greatly different, but becomes markedly so after the burning oil stage. The heavier products of being for pavements, coverings for underground electric wires, fuel, etc.

As to extensions of the oil territory, Mr. Jenkins states, under date of 23rd November, 1911, that there were then two small groups of wells pumping oil in the township of Brooke, but the wells were small, and inducements to extend were therefore absent. Some years ago in the northern part of the peninsula attempts were made to see what there might be in the Trenton. Shows were got, but no volume of production was struck. There was at the time of writing a little flurry about Delaware. What shows were got were in the Corniferous, which rises as it goes east, and volume at Delaware is not yet proved.

Mr. John Scott, Petrolea, Inspector of gas and oil wells under 7 Edward VII., chapter 47, reports that 397 wells were abandoned during 1911 in the Lambton county and adjacent oil fields. There were also 687 wells from which the pumps had been removed, about half of which were being baled.

Natural Gas

The situation with regard to natural gas is the opposite of that as respects petroleum. While the yield of petroleum is lessening, the yield of natural gas is rapidly increasing. In 1909 the output had a value of $1,188,179, in 1910, $1,491,239, and in 1911, $2,186,762.

The natural gas territory borders on the east and north shores of lake Erie, and the gaps between the areas at present productive are steadily being obliterated, and in such a way as to make it not improbable that practically the whole shore will in time be found to be underlaid by gas-bearing strata. It has already been shown by wells drilled in the land under the water of lake Erie in front of the township of Rainham that the gas field includes portions of the bed of that lake. The outlines of the gas field in Kent county, and the large yield of wells on the shore line, strongly suggest that there is an extension of the field, probably one of considerable size, beneath the waters of the lake in that district also.

The largest single producer is the Dominion Natural Gas Company, whose head office is at Pittsburgh, Pennsylvania. The Volcanic Oil and Gas Company, Chatham; the Leamington Oil Company, Detroit; the United Fuel Supply Company, Sarnia; and the Provincial Natural Gas and Fuel Company, Niagara Falls, also produce and market large quantities of gas.

Mr. Donald Sharpe, of Welland, is also an inspector for the purpose of enforcing the provisions of the above-mentioned Act, which requires all abandoned gas and oil wells to be properly plugged. In his report for the year 1911, Mr. Sharpe, whose territory covers the counties of Welland, Haldimand, Brant, Norfolk, Wentworth, and Elgin, in which the gas is much more important than oil, states that the producing wells drilled during the year were 254 in number, distributed by counties as follows—Welland 26, Haldimand 124, Brant 60, Norfolk 19, Wentworth 9, and Elgin 16. The dry holes put down number 44. From the new gas and oil field in the township of Onondaga, county of Brant, the output of gas was about 350,000 cubic feet per day, and of oil about 2,500 barrels per month. There are now 25 gas and 32 oil wells in that field. A good gas field has been developed at Vienna, Elgin county, and mains have been laid to supply Tillsonburg and Aylmer with gas. The larger companies are doing their best to keep the wells free from water, while some small companies and private individuals, on account of not having proper machinery, do not care for their wells as they should. By reason of the great quantity of gas being used for manufacturing purposes, and the freezing up of many of the small pipes during the cold weather, many people were much inconvenienced as a result of the shortage of gas. Mr. Sharpe adds:—"If gas were available for domestic purposes only, the companies would be enabled to give the public a better service, and natural gas would last for many years."

To Mr. Sharp's report is appended a list of the producers of natural gas in Welland, Haldimand, Norfolk, Elgin, Brant, Oxford and Wentworth, as follows:—

Producers of Natural Gas in Welland-Haldimand Field

Name of Company	P.O. Address	No. of Wells
Aldrich Oil & Gas Company	Selkirk, Ont.	10
Bertie Natural Gas Company	Ridgeway, Ont.	6
Beck & Aikens	Cayuga, Ont.	12
Canfield Natural Gas Company	Canfield, Ont.	3
Cheapside Natural Gas Company	Cheapside, Ont.	3
Canboro Natural Gas Company	Canboro, Ont.	3
Coleman, J. A.	Wellandport, Ont.	3
Dominion Gas Company	Bank Hamilton Chambers, Hamilton, Ont.	299
D. Kindry & Sons	Selkirk, Ont.	6
Danskin, D.	Onondaga, Ont.	2
Empire Limestone Company	Sherkston, Ont.	17
Enterprise Gas Company	Delhi, Ont.	6
Holmes Gas Company	Selkirk, Ont.	33
Home Natural Gas Company	C o Robt. Foster, Hamilton, Ont.	5
Hoover, Jas. E.	Selkirk, Ont.	4
Hoover, D. E.	Selkirk, Ont.	2
Humberstone Natural Gas & Fuel Co.	Humberstone, Ont.	3
Industrial Natural Gas Co.	Port Robinson, Ont.	17
Kohler & Aikens	Cayuga, Ont.	15
Lint & Emerson	Attercliff, Ont.	3
Lamb, Alfred	Selkirk, Ont.	16
Lamb, Walter	Nanticoke, Ont.	7
Lalor, F. R.	Dunnville, Ont.	5
Lawson, J. J.	Stromness, Ont.	3
Marshall, James	Lime Works, Hamilton, Ont.	17
Melick & Moote	Dunnville, Ont.	4
Midfield Natural Gas Company	32 Stinson Street, Hamilton, Ont.	7
Moore & Ricker	Canboro, Ont.	2
Miller, R. F.	Rainham Centre, Ont.	16
Medina Natural Gas Company	Chatham, Ont.	8
North Western Gas Company	Reed Block, Erie, Pa.	5
North Shore Natural Gas Company	C o S. C. McDonald, Hamilton, Ont.	12
Nanticoke Oil & Gas Company	Nanticoke, Ont.	2
Norfold Gas Company	Port Dover, Ont.	9
Ontario Pipe Line Company	Hamilton, Ont.	7
Onondaga Oil & Gas Company	Brantford, Ont.	12
Oxford Oil & Gas Company	17 Albion Street, Brantford, Ont.	4
Ontario Iron & Steel Company	Welland, Ont.	16
Provincial Natural Gas & Fuel Company	Niagara Falls, Ont.	173
Port Colborne-Welland Natural Gas Co.	Port Colborne, Ont.	25
Producers Natural Gas Company	Bank of Hamilton Chambers, Hamilton, Ont.	96
Port Maitland Natural Gas Company	Port Maitland, Ont.	2
Port Rowan Natural Gas Company	Port Rowan, Ont.	8
Rolston & Bennett	Dunnville, Ont.	2
Roth & Wilcox	C o S. C. McDonald, Hamilton, Ont.	2
Regal Gas Company	Hagersville, Ont.	4
Sterling Gas Company	Port Colborne, Ont.	45
Steele, J. A.	Humberstone, Ont.	6
Standard Natural Gas Company	Dunnville, Ont.	25
Selkirk Gas Company	Selkirk, Ont.	12
South Cayuga Natural Gas Company	South Cayuga, Ont.	2
Toronto Niagara Power Company	King Street East, Toronto, Ont.	9
Telephone City Oil & Gas Co.	Brantford, Ont.	3
United Gas Companies, Limited	St. Catharines, Ont.	44
Vansickle, A. W.	Onondaga, Ont.	3
Wanes & Root	Dunnville, Ont.	73
Welland County Lime Works	Port Colborne, Ont.	30
Wellandport Natural Gas Company	Wellandport, Ont.	3
	Total Number of Wells	871

Mr. G. R. Mickle, M.E., Mine Assessor, whose duties in collecting the revenue from natural gas—two-tenths of one cent per thousand cubic feet on gas used in Canada, and 2 cents on gas exported or wasted—place him in a position to speak with authority regarding the natural gas industry of the Province, furnishes the following brief notes on the three several fields:—

The Kent Gas Field

The Kent gas field seems likely to prove the most important one in Ontario in the future, and it is desirable therefore to have an approximate record of the production from this field. In order to make operations here comprehensible, it is necessary to refer briefly to the history of gas production from this area. During the search for oil in 1906 gas was found. It was some time before it was realized that there was an important gas field, and that the gas was far more valuable than the oil. On 19th March, 1907, gas was turned into the Chatham mains by the Volcanic Oil and Gas Company, to whose skill and enterprise is chiefly due the fact that it was possible to preserve the gas supply. During 1906 and the early part of 1907 whatever gas was found by the oil operators was allowed to escape. The writer estimates that during this time about 1,500 million feet were wasted. In all, about 125 oil wells have been drilled, using probaoly 3,000,000 feet of gas each in the course of drilling, making 1,875 million feet of gas that must be credited to the search for oil.

As explained on p. 152, Nineteenth Report Bureau of Mines, one barrel of oil is equal to 5,400 cubic feet of gas in heating power, and consequently actual value, therefore the equivalent of 347,000 barrels of oil was sacrificed in searching for oil. The amount of oil that has been produced in the Tilbury and Romney field up to the end of 1911 is 955,631 barrels, and the oil production is dropping in geometrical progression about 50 per cent. each year, thus:—106,992 (first year, only part year), 411,588—201,283—124,003—63,058—48,707 barrels. Of the amount produced only an insignificant proportion, viz., considerably less than 10,000 barrels, has been derived from the gas field, as outlined in the Nineteenth Report of the Bureau referred to above. All the rest was from the adjoining oil territory; the distinction between the two being that in the gas field the gas occupied strata of rock above the oil, and unless the drilling was carried too far not a particle of oil would be found; whereas in the oil territory the two are found together. This amount of 1,875 million feet of gas wasted would supply 10,000 people for 1,875 days, or about five years. On the basis of the consumption for domestic purposes in Chatham, with 10,000 inhabitants, it would last seven years. It is evident that in this particular case what was sacrificed far exceeded in value (more than thirty times) what was ultimately produced. If the same condition should arise again, there is no efficient legislation to prevent a recurrence of these events.

The total gas yield up to the end of 1911 from the Kent field is approximately as follows:—

	Cu. Ft.
Waste in 1906 and early part of 1907	1,500 million
Drilling oil wells	375 "
Waste subsequent to enforcement of penalties for wasting gas in 1907 and gas used in drilling operations unaccounted for	125 "
Total	2,000 "

This is the amount outside the production which is utilized each year.

The amount of gas delivered yearly to consumers has increased rapidly; for 1908, the first full year of production, it was 848 million, and for 1911 5,649 million, the total amount being 13,379 million; with the 2,000 million already mentioned, this makes a total of 15,379 million coming from this field up to end of 1911. On the basis explained above, this is equivalent to 2,850,000 barrels of oil. The total production of gas from this field will undoubtedly go well beyond 100,000 million feet.

Elgin Field near Port Burwell

This was described in last year's Report. The production from this field to end of 1911 has been 126 million cubic feet. Up to the present time there is no reason to suppose that this will prove a very important field.

Welland-Haldimand-Norfolk-Brant Field

New operations in this territory have been chiefly confined to testing the area farther westward and northward, and drilling in patches of land which had been neglected or insufficiently tested before. This has been attended by an encouraging amount of success. The market for gas is good and the drain on the gas supply is very heavy. The percentage of gas used for industrial purposes as opposed to domestic is not so great from this field as in Kent.

For 1911 the production from this area was approximately 4,000 million cubic feet.

Minor Products

A feature of Ontario's mineral industry is the variety of its products, which include most of the metals and a number of non-metallic substances, in addition to those dealt with under their respective headings above. Most of them are being produced in considerable quantity, and in the case of many the supply is limited only by the demand. Among these substances are corundum, feldspar, fluorspar, graphite, gypsum, peat, phosphate of lime, quartz and talc, to which may be added, among manufactured products, calcium carbide. A few notes on these will not be out of place.

Calcium Carbide

For a number of years, in fact almost since the discovery of the fact that lime and carbon fused together would on the application of water emit acetylene gas, which could be utilized for illuminating purposes, a factory for the production of calcium carbide has been operated at Merritton, on the old Welland canal. Some years later another plant was established at Ottawa, both factories taking advantage of cheap water power for the necessary electrical current. The output of these works for 1911 was 1,383 tons, valued at $84,437. In the previous year 3,072 tons were produced valued at $184,323. The explanation of the decrease lies in the fact that the Ottawa Carbide Company sold out to the Canada Carbide Company, Limited, of Montreal, and ceased operations after the sale, having run the plant for 120 days only. The Willson Carbide Company, which carried on the manufacture at Welland, also went out of business on 13th June.

Corundum

The production of grain corundum last year was 1,471 tons, worth $147,158. In 1910 it was 1,870 tons, having a value of $171,944. Formerly, there were two companies engaged in mining and preparing corundum for the market, but in 1910 the Manufacturers' Corundum Company, Limited, acquired the property of the Canada Corundum Company, and leased the mines and works of the Ashland Emery and Corundum Company, thus obtaining sole control. An average of 199 men were employed during the year, earning wages amounting to $124,491. The corundum of Ontario is found as crystals embedded in syenitic rock, from which they are separated by crushing and concentration. The finished product is graded into sizes according to the size of the grains, and is used for abrasive, cutting and polishing purposes in the treatment of metal goods. In hardness corundum stands next to the diamond. Chemically it is pure alumina, and efforts have been made to employ it as an ore of aluminium, but the problem of getting rid of the oxygen has proven a difficult one. It is much richer in the metal than bauxite, the raw material usually employed for the production of aluminium. The mines are situated at Craigmont and Burgess mines, the former being in the county of Renfrew and the latter a short distance away in the county of Hastings.

Feldspar

The variety of feldspar raised in Ontario for commercial purposes is microcline, pink or salmon-red in color and containing 13 or 14 per cent. of potash. It is exported to the potteries of Ohio and New Jersey, and is also utilized in the manufacture of enamelled ware. The quarries are situated near Verona, in the county of Frontenac, on the Kingston and Pembroke railway. Some 17,697 tons were raised and shipped in 1911, valued at $51,610, as against 16,374 tons in 1910, worth $47,518. The largest production was by the Kingston Feldspar and Mining Company, Kingston, smaller quantities being raised by the Dominion Improvement and Development Company, Perth; the McDonald Feldspar Company, Toronto, and the Ojaipee Silica and Feldspar Company Toronto. The property operated by the last-mentioned company is situated at

Long lake, in the township of Conger, Parry Sound district. Several quarries owned by other persons or firms in the neighborhood of Verona were idle during the year.

Graphite

Two companies, the Globe Refining Company, Limited, at Port Elmsley, and the Black Donald Graphite Company, Calabogie, raised a total of 4,833 tons of crude graphite ore in 1911, and shipped refined products from their treating plants to the extent of 894 tons, worth $36,492. The Virginia Graphite Company is developing a property and erecting a plant near Wilberforce, but has not yet shipped any ore or product. Graphite has many uses, being employed in the manufacture of crucibles, in lead pencils, as a lubricant for foundry facings, as stove polish, etc. It is sometimes known as plumbago, and also as "black lead."

Gypsum

The deposits of gypsum at present being worked in Ontario are situated in the valley of the Grand river, near Caledonia, and elsewhere. Last year the output of the mines was 20,335 tons, valued in a crushed but otherwise crude condition at $32,535. The Alabastine Company, of Paris, manufactures a variety of products from gypsum, such as wall plaster, alabastine for kalsomining, etc., obtaining its supply of raw material from Caledonia. The Crown Gypsum Company's mill was destroyed by fire in 1911, but the company set about the work of rebuilding and hoped to be in a posiiton to resume operations by April 1, 1912.

The gypsum resources of the Hudson Bay slope appear to be very extensive, and are described in several of the Reports of the Geological Survey of Canada[6] and of this Bureau,[7] also by Mr. E. B. Borron, the veteran explorer of northern Ontario, in his Report on the Basin of the Moose River. Dr. W. A. Parks speaks of an exposure of gypsum on the Nipissing-Algoma boundary line near the French river, a tributary of the Moose, "having a diameter of three miles in all directions"; also of a deposit cut by the east branch of the French river, 20 chains long and 12 feet thick where exposed; and of a third deposit on the Missanabie river, about 22 miles up stream from the mouth of the Abitibi, extending on both sides of the river for about a mile and a half. J. M. Bell refers to the occurrences of gypsum at White Rocks on the banks of the Moose river, where there are two separate groups of deposits, the upper one extending for two miles and a half or two miles and three-quarters on both sides of the river, and the lower one for about a mile. The National Transcontinental and Temiskaming and Northern Ontario railways have brought these deposits within nearer range, but they are still too remote to warrant their being opened up and worked.

Quartz

Seven companies or firms were engaged in producing quartz during 1911, as follows: Canadian Copper Company, Copper Cliff; Mond Nickel Company, Victoria Mines; McPhail and Wright Construction Company, Sault Ste. Marie; Kingston Feldspar and Mining Company, Kingston; A. B. Willmott, Toronto; and McDonald Feldspar Company, Toronto. The material raised by the nickel-mining companies, as well as by some of the other producers, was for use in blast furnace operations; the remainder was required for a variety of purposes. Quartz is one of the two constituents in the manufacture of ferro-silicon, the other being iron ore, and it is also employed in one of the processes for the production of sulphuric acid.

The total quantity quarried and shipped last year was 56,723 tons, valued at $64,405. The production in 1910 was 90,685 tons, valued at $87,424. One hundred and ten men found employment in the quartz quarries, and earned in wages $40,459.

Talc

The principal talc deposit at present in operation is in the township of Huntingdon, county of Hastings, and is worked by Messrs. Cross and Wellington. Its product goes to the talc mill at Madoc, owned by Messrs. Geo. H. Gillespie and Company, where it is ground and graded according to fineness and quality. A deposit at Eldorado was opened last year by the Canadian Talc and Silica Company, Limited, and a plant installed for treating the output. A small quantity of talc was put through the mill and converted into commercial products. In all 5,404 tons of ground talc were shipped out, worth $47,725. There are a number of uses to which ground talc is put. Perhaps the largest quantity is used in the paper-making trade; it is also employed in the manufacture of cosmetics and soap, as talcum powder, etc. The industry gave employment to 38 men, who were paid in wages the sum of $17,530.

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[6] Rep. Gen. Sur. Can., 1875, p. 321.

[7] Eighth Rep. B.M., 1899, pp. 190, 191, 194, also 13th Rep. 1900, pp. 156 etc.

Miscellaneous

A small quantity of phosphate of lime, about 20 tons, was shipped from a property in North Burgess, worked by the Dominion Improvement and Development Company. About 1,500 tons were mined during the year.

From a deposit of fluorspar, owned by Mr. F. F. Battle, in the township of Huntingdon, Hastings county, Messrs. Cross and Wellington shipped about 30 tons, valued at $200.

The Olden or Long Lake zinc mine in the county of Frontenac was worked for the greater part of the year, but no shipments were made. The Albemarle Zinc Company, London, extracted from an opening near Wiarton about 7 tons of sphalerite and shipped it to Cleveland, Ohio. The assay showed it to contain zinc, 47.97 per cent.; sulphur, 21.60 per cent.; lime (CaO), 9.77 per cent., iron, 0.60 per cent., and lead, 0.007 per cent.

The manufacture of peat fuel is receiving considerable attention from the Department of Mines, Ottawa, which established an experimental and demonstration plant at Alfred, in the county of Prescott. Of the product, 265 tons were sold to customers at the village of Alfred, and 815 tons were shipped by rail to Montreal and Ottawa, and sold at $3.25 per ton. The peat was used in parlor grates, in kitchen ranges, and in furnaces. It burns to a fine ash, there being practically no residue, and at the above price is said to be cheaper than coal. Dr. J. McWilliam, of London, has for some time been experimenting with a peat fuel plant in the township of North Dorchester. He produced a small quantity last year, but expects a larger output in 1912. In all, 1,180 tons of Ontario peat fuel was marketed in 1911.

Mining Revenue

For the fiscal year ending 31st October, 1911, the Province derived a revenue from mining sources, amounting to $798,920.01, a decrease, as compared with the previous twelve months, of $142,110.08. Following is a comparative statement for the two years:—

Service.	12 months ending 31st October, 1910.	12 months ending 31st October, 1911.
	$	$
Sales of mining land	327,160.12	64,268.43
Rental leases do.	29,008.79	25,797.14
Miners' licenses, permits, and fees	193,682.48	211,168.57
Mining royalties	246,529.13	285,913.26
Supplementary Revenue Act, 1907	143,209.59	209,161.51
Provincial mine	549.77	318.73
Provincial Assay Office	890.21	1,362.37
Total	941,030.09	798,920.01

It will be observed that the only item in which there is a serious falling-off is receipts from the sale of mining lands, in which the reduction is $262,531.69. This decrease is more than offset by increases in the other sources of revenue, and is due entirely to the fact that a considerable amount of purchase money for mining locations on the Gillies limit were included in the receipts for 1910, but nothing in 1911. The following table gives particulars of the lands sold and leased during the year:—

Table XVI.—Mining Lands Sold and Leased for year ending October 31st, 1911

District.	Sales.			Leases.			Total.		
	No.	Acres.	Amount.	No.	Acres.	Amount.	No.	Acres.	Amount.
			$			$			$
Nipissing	246	9,169.68	24,053.30	224	9,759.40	11,225.99	470	18,929.08	35,279.29
Sudbury	129	5,808.97	14,073.26	19	532.65	532.65	148	6,341.62	14,605.91
Thunder Bay	132	6,596.30	11,480.03				132	6,596.30	11,480.03
Algoma	38	2,303.61	3,376.05				38	2,303.64	3,376.05
Kenora	39	2,520.65	3,477.13				39	2,520.65	3,477.13
Parry Sound	4	170.00	470.00				4	170.00	470.00
Rainy River	8	206.00	206.00				8	206.00	206.00
Elsewhere	16	1,148.84	1,862.00				16	1,148.84	1,862.00
Total	612	27,924.08	58,997.77	243	10,292.05	11,758.64	855	28,216.13	70,756.41

The total received, as shown in the above table—$70,756.41—does not agree with the total of receipts from mining sales and mining leases in the preceding schedule. The explanation of this is that the latter represents only the transactions properly belonging to the fiscal year, while the former includes all sums received by the Department, whether for completed or uncompleted transactions, arrears, etc.

For miners' licenses, permits to search for minerals in forest reserves, and recording fees, there was an increase of $17,486.09. Details making up the total of $211,168.57 are:

Miners' licenses	$78,800 60
Forest Reserve permits	6,291 38
Recording fees	126,676 59
Total	$211,768 57

The receipts for these services serve as a barometer to show the degree of activity prevailing in the staking out of mining claims and speculation in mining lands. The discovery of a new and promising mineral district is immediately followed by a rush to stake out claims, and a corresponding increase in the receipts of mining recorders for licenses, and the recording and transfer of claims. It so happens that much of the prospecting and claim-staking during the last few years, including 1911, was done in the mineral belts lying within the boundaries of the Temagami forest reserve. To prospect in a reserve implies possession of a permit, the charge for which is $10 per annum. This charge has been criticized, but it must not be overlooked that the presence of a large number of prospectors in a coniferous forest, especially during the dry season of the year, exposes the timber to danger from fire, and necessitates the employment of a larger number of fire rangers than would otherwise be required.

Mining Royalties

Collections on account of mining royalties were as follows:—

Crown Reserve Mining Company	$186,356 59
Chambers—Ferland Mining Company	10,000 00
Hudson Bay Mines	27,247 17
O'Brien Mine	60,252 26
Cobalt Provincial Mining Company	1,722 66
Wyandoh Mining Company	334 58
Total	$285,913 26

In all, the receipts from mining royalties, from the time of their imposition to the end of 1911, have been $1,313,463.35, as shown in the following statement:—

O'Brien Mine	$596,305 70
Crown Reserve Mining Company	475,811 01
Hudson Bay Mines (formerly T. & H. B. Mining Co.)	208,511 44
Chambers-Ferland Mining Company	26,259 64
Hargrave Mining Company	2,777 28
Cobalt Provincial Mining Company	1,722 66
Wyandoh Silver Mines	1,298 14
Waldman Silver Mines	777 48
Total	$1,313,463 35

Supplementary Revenue Act, 1907

Details of payments under the provisions of the Supplementary Revenue Act, 1907, for the fiscal year, ending 31st October, 1911, are as follows:—

Profit Tax	$176,314 23
Natural Gas Tax	18,576 37
Acreage Tax	14,570 91
Total	$209,461 51

The following information is furnished by Mr. G. R. Mickle, M.E., Mine Assessor, with regard to the operation of the Supplementary Revenue Act. It will be noted that Mr. Mickle deals with the calendar year, 1911, (except as to the acreage tax), and not the fiscal year, ending with October, 1911, hence his figures do not agree with those given above.

Three different kinds of taxes are levied under this Act, viz.: (1) Profit tax, being on profits of all mines in the Province in excess of $10,000, with certain deductions for taxes paid municipalities; (2) Natural gas tax, this is a levy of two-tenths of a cent per thousand feet on such gas as is used in Canada; (3) Acreage tax of two cents per acre on all mining lands not in an organized municipality, and which, therefore, would otherwise be free of all taxes.

The amounts collected under this Act belonging to the calendar year, 1911, were as follows:—

(1) Profit Tax	$131,577 75
(2) Gas Tax	17,728 36
(3) Acreage Tax (15th April, 1911, to 15th April, 1912)	13,862 52
Total	$163,168 63

This is about 16 per cent. in excess of the amount collected in 1910. As payments, according to this Act, are not due till October 1st, and the fiscal year for the Province ends on October 31st, there are always a certain number of payments due in the calendar year which fall in the next fiscal year. This statement, therefore, cannot agree with the public accounts.

The profit tax was collected from twelve different companies, most of it being from the silver mines of Cobalt. Certain mines in the Cobalt district, which pay a royalty, may, according to the terms of the agreement with the Crown, deduct any tax payable to the Crown from the royalty. It has been the practice, therefore, not to collect the tax from these mines. This proviso makes the amount collected under the tax smaller by about $42,000 than it otherwise would have been. The royalty is, of course, greater by the same amount. Outside of the tax collected from silver and nickel mines and a very small amount due to operations of pyrites deposits, the other ores yielded no revenue in 1911. The tax is based on the results of the preceding year, hence nothing was due from gold mines. There is no substantial variation in the amount that will be collected as profit tax apparent in the immediate future.

The gas tax was collected from 41 different companies or individuals. New producers are constantly appearing and being bought out. About three-quarters of the tax was paid by six companies, and twenty-two of those contributing paid amounts under $100 each. The increase in gas tax over the amount paid last year (about $5,000), is due chiefly to the increased production of the Kent field, which gave about one-half of the total yield of the Province for the year. The revenue from this source will probably rise for a year or so, and then must drop, unless some important new field is found.

The acreage tax is about, as may be expected, every year. No attempt is made to keep the tax for the different years separate in the case of the acreage tax, as in many cases several years are paid at once, either in advance or in arrears, with penalties. No expansion in mining can increase the acreage tax materially. If the mining operations are successful in any district, a stable population results, municipalities are formed, and the acreage tax automatically disappears. Moreover, under the Mining Act, now in force, the areas taken up are small, and are generally abandoned before the time when the land must be patented, unless substantial encouragement is received.

Lands two years in arrears are advertised and forfeited, if the tax is not paid before a certain date. The list now ready for publication contains only about 2 per cent. of the taxable area; last time, it was 27 per cent. According to the experience last time, about one-half of the lands advertised were redeemed before the date of forfeiture; this would leave only 1 per cent. liable to forfeiture.

Mining Companies

The number of mining companies incorporated or licensed to do business year by year in Ontario is an indication rather of the degree of speculation prevailing at the time, than of the actual amount of mining work or production going forward. Much the larger proportion of these companies have a very ephemeral existence; many, indeed, are still-born, and, after the lapse of a year or two, disappear, leaving "not a wrack behind." If a play upon words is permissible in a Government report, it may be said that, in not a few instances, however, they leave a "wreck" behind. Tempted by an inflammatory prospectus, unwary investors part with their money for shares, because they are cheap, and because there is a prospect of their going up in value. Indeed, the date of the advance is frequently announced beforehand by the vendor, who admonishes his patrons to buy at once, and thus secure a certain profit. The mining industry suffers much from the tribe of company-mongers, for, when money is lost in mining shares, the blame is laid on the business itself, and not where it belongs—on the swindling sellers and the avaricious buyers of worthless stock.

Two hundred and thirteen companies were incorporated under the Ontario Companies' Act, with an aggregate nominal capital of $215,640,000, or an average of about a million dollars each. In addition, nineteen companies of extra-Provincial incorporation were licensed to do business in Ontario. In 1910, the number of incorporating companies was one hundred and sixty-two, and their total capitalization, $128,999,300, while the extra-Provincial companies receiving licenses numbered fourteen.

Following is the list:—

Table XVII.—Mining Companies Incorporated in 1911

Name of Company.	Head Office.	Date of Incorporation.	Capital.
Abaca Porcupine Gold, Limited	Toronto	May 12, 1911	$ 40,000
Aberdeen Porcupine Exploration Company, Limited	Toronto	Sept. 19 "	25,000
Acme Gold Mines, Limited	Toronto	Dec. 13 "	3,000,000
Algoma Brick and Tile Company, Limited	Sault Ste. Marie.	Aug 28 "	40,000
Anglo American Development Company, Limited	Toronto	June 6 "	100,000
Anglo Canadian Exploration and Development Company, Limited.	Toronto	Dec. 11 "	250,000
Apex Porcupine Mines, Limited	Toronto	Mar. 11 "	2,000,000
Beaver Asbestos Company, Limited	Walkerville	Feb. 11 "	500,000
Brandons Pressed Brick and Tile Company of Milton, Limited	Milton	Feb. 21 "	100,000
Bricks, Limited	Oshawa	July 19 "	40,000
Canada Iron Mines, Limited	Toronto	Mar. 28 "	1,500,000
Canada Lime Company, Limited	Toronto	April 24 "	100,000
Canadian Homestake Gold Mining Company, Limited	Toronto	April 19 "	1,000,000
Canadian Mining and Finance Company, Limited	Toronto	Dec. 9 "	500,000
Central Ogden Mines Company, Limited	Cobalt	May 10 "	1,000,000
Chapman Brick Company, Limited	Toronto	Jan. 25 "	40,000
Colorado Porcupine Company, Limited	Toronto	Mar. 2 "	40,000
Consolidated Swastika Mines, Limited	Toronto	July 29 "	2,000,000
Cordova Mines, Limited	Cordova Mines	July 10 "	500,000
Crown Reef Mines, Limited	Toronto	Feb. 9 "	1,000,000
Davidson Gold Mines, Limited	Toronto	Mar. 29 "	2,000,000
Deloro Porcupine Gold Mining Company, Limited	Ottawa	Feb. 20 "	40,000
Detroit Kenora Gold Mining Company, Limited	Windsor	Mar. 14 "	40,000
Detroit New Ontario Mines, Limited	Matheson	Feb. 1 "	1,000,000
Dobie Mines, Limited	Porcupine	Mar. 24 "	1,500,000
Dome Lake Mining Company, Limited	Toronto	Mar. 23 "	2,500,000
Dome Lake Porcupine Mines Limited	Toronto	Mar. 21 "	40,000
Dominion Porcupine Mines, Limited	Toronto	Dec. 7 "	3,000,000
Dominion Refineries, Limited	North Bay	Jan. 21 "	50,000
Duluth-Shining Tree Company, Limited	Toronto	Dec. 15 "	300,000
Eldorado Porcupine Mines, Limited	Toronto	Mar. 17 "	500,000
Eleanore Gold Mines Company of Porcupine	Toronto	June 13 "	1,000,000
Elgin Oil and Gas Company, Limited	St. Thomas	Nov. 7 "	200,000
Eplett-Caswell Mining Company, Limited	Coldwater	Jan. 26 "	100,000
Foley O'Brien Limited	Toronto	April 3 "	3,000,000
General Holding and Development Company, Limited	Toronto	Jan. 17 "	25,000
Gillies Lake Mines, Limited	Toronto	Mar. 29 "	2,000,000
Gold Crest Mines Company, Limited	Toronto	Nov. 16 "	2,000,000
Golden Age Mines, Limited	Toronto	July 14 "	100,000
Golden Centre Mill and Mines, Limited	Toronto	Mar. 29 "	600,000
Golden Porcupine Mines, Limited	Toronto	April 27 "	1,500,000
Grand River Oil and Gas Company, Limited	Brantford	Feb. 25 "	40,000
Great Golconda Mines, Limited	Toronto	Jan. 23 "	1,000,000
Harbour Brick Company, Limited	Toronto	May 5 "	50,000
Henley Porcupine Mines Limited	Toronto	Oct. 17 "	1,000,000
Hobon Gold Mines, Limited	Toronto	April 24 "	1,000,000
Hollinger Reserve Mines, Limited	Toronto	Aug. 3 "	2,000,000
Homestead Mines of Swastika, Limited	Toronto	June 5 "	2,000,000
Hughes Porcupine Mines, Limited	Toronto	June 14 "	2,500,000
Interlaken Mines, Limited	Ottawa	May 26 "	350,000
Iroquois Porcupine Mining Company, Limited	Toronto	June 14 "	1,000,000
Jajola Cobalt Porcupine Syndicate, Limited	Toronto	July 25 "	40,000
Jupiter Mines, Limited	Toronto	Mar. 17 "	2,000,000
Lake of the Woods Gold Mining Company, Limited	Toronto	Aug. 22 "	1,500,000
La Palme Porcupine Mines, Limited	Toronto	July 12 "	2,000,000
Leamington Brick and Tile Company, Limited	Leamington	April 3 "	10,000
Lenox Mining and Prospecting Company, Limited	Welland	Sept. 2 "	40,000
Lost and Found Mining Company, Limited	Toronto	July 18 "	40,000
Lucky Cross Mines of Swastika, Limited	Toronto	June 14 "	1,500,000
McCullough Mining Company, Limited	Toronto	May 5 "	1,000,000
McIntyre Porcupine Mines, Limited	Toronto	Mar. 16 "	1,000,000
McLean Gold Mines, Limited	Ottawa	April 7 "	1,500,000
Major Mining Company, Limited	Windsor	Dec. 9 "	25,000
Maple Leaf Oil Company, Limited	Toronto	Jan. 10 "	1,000,000
Martin Porcupine Mines, Limited	Toronto	Nov. 8 "	2,000,000
Master Mine, Limited	Windsor	April 19 "	500,000
Miller Lake Silver-Lodes Mining Company, Limited	New Liskeard	Dec. 29 "	60,000
Mines Products, Limited	Toronto	Jan. 5 "	40,000
Minnesota Porcupine Company, Limited	Toronto	Mar. 2 "	500,000
Missanoga Silver Mining and Development Company, Limited	Napanee	Jan. 31 "	100,000
Moffat-Irving Electric Smelters, Limited	Toronto	Mar. 1 "	40,000
Montreal Tisdale Gold Mines, Limited	Sault Ste. Marie.	Dec. 31, 10 "	2,000,000
Mulholland Mines Company, Limited	Toronto	Feb. 23 "	1,500,000
Niagara Porcupine Mining Company of Ontario, Limited	Toronto	Feb 15 "	40,000
Niagara Pressed Brick Company, Limited	Berlin	Aug. 10 "	40,000
North American Exploration and Development Company, Limited.	Toronto	Feb. 14 "	50,000
North Dome Mining Company, Limited	Toronto	Mar. 30 "	2,000,000
Northern Gold Reef, Limited	Toronto	Sept. 23 "	3,500,000
Oliver Silver Mining, Limited	Ottawa	May 31 "	3,000,000
Ontario Gold and Silver Mines, Limited	Toronto	Sept. 9 "	1,000,000
Ontario Lime Company, Limited	Toronto	Dec. 23 "	500,000
Ore Concentrators and Refineries, Limited	Toronto	April 3 "	1,000,000
Otto Gold Mines, Limited	Haileybury	June 20 "	1,000,000
Patricia Porcupine Mines, Limited	Toronto	Oct. 2 "	3,000,000
Peerless Porcupine Mines, Limited	Toronto	Mar. 20 "	2,000,000
People's Silver Mines, Limited	Toronto	May 6 "	1,500,000
Philadelphia Mining and Developing Company, Limited	Cobalt	July 8 "	40,000

Table XVII.—Continued.

Name of Company.	Head Office.	Date of Incorporation.	Capital.
Pioneer Porcupine Gold Mines, Limited	Ottawa	Mar. 28, 1911	$1,000,000
Platt Veteran Gold Mines, Porcupine, Limited	Toronto	May 11 "	2,000,000
Plenaurum Mines, Limited	Toronto	June 30 "	2,500,000
Plevna Mica and Mining Company, Limited	Kingston	Sept. 30 "	800,000
Porcupine and Hudson's Bay Gold Mines, Limited	Toronto	May 29 "	2,500,000
Porcupine Aurum Mining Company, Limited	Toronto	July 14 "	1,000,000
Porcupine Canada Gold Mines, Limited	Toronto	Mar. 23 "	1,000,000
Porcupine-Cobalt Mines, Limited	Toronto	May 26 "	1,000,000
Porcupine Coronation Gold Mines, Limited	Toronto	Mar. 25 "	1,000,000
Porcupine East Lake Mining Company, Limited	South Porcupine	Dec. 29 "	500,000
Porcupine Eastern Gold Mines Company, Limited	Porcupine	April 24 "	1,000,000
Porcupine Gold Belt Mines, Limited	Toronto	Aug. 17 "	1,500,000
Porcupine Gold Peak, Limited	Toronto	Dec. 8 "	1,500,000
Porcupine Gold-Spot, Limited	Toronto	May 16 "	1,000,000
Porcupine-Hecla Mining Company, Limited	Toronto	Nov. 30 "	1,500,000
Porcupine Independence Mines, Limited	Toronto	May 19 "	1,000,000
Porcupine Kendall Gold Mines, Limited	Toronto	July 3 "	2,000,000
Porcupine Keora Mining Company, Limited	Haileybury	April 6 "	2,000,000
Porcupine Merger Mines, Limited	Toronto	Mar. 23 "	1,500,000
Porcupine Midas Mining Company, Limited	Toronto	Aug. 24 "	2,000,000
Porcupine Mohawk Mines, Limited	Toronto	May 9 "	2,000,000
Porcupine Northern Mines, Limited	Toronto	Jan. 6 "	40,000
Porcupine Ores, Limited	Toronto	Feb. 18 "	40,000
Porcupine Panamint Gold Mines, Limited	Toronto	June 6 "	1,500,000
Porcupine Reserve Mines, Limited	Toronto	Feb. 24 "	2,000,000
Porcupine Southern Mines, Limited	Toronto	June 24 "	40,000
Porcupine Townsite Mines, Limited	Toronto	Mar. 20 "	1,000,000
Porcupine Veterans' Exploration Company, Limited	Toronto	Aug. 17 "	80,000
Powell Gold Mines, Limited	Ottawa	April 13 "	3,000,000
Premier Langmuir Mines, Limited	London	April 20 "	2,000,000
Preston East Dome Mines, Limited	Toronto	Jan. 7 "	3,000,000
Rands Mines of Porcupine, Limited	Toronto	Mar. 31 "	2,000,000
Rea Consolidated Gold Mines, Limited	Toronto	April 5 "	1,000,000
Reciprocity Mines of Porcupine, Limited	Toronto	Aug. 29 "	1,000,000
Red Cliffe Phillip Gold Mining Company, Limited	Kenora	June 30 "	2,500,000
Redstone Mining Company, Limited	Toronto	June 30 "	1,000,000
Roche Porcupine Gold Mining Company, Limited	Ottawa	July 18 "	3,000,000
Rose Hill Natural Gas Company, Limited	Bridgeburg	July 17 "	5,000
Ross Gold Mines, Limited	Toronto	Sept. 11 "	3,000,000
Royal Dome Gold Mines, Limited	Hamilton	Aug. 31 "	2,000,000
St. Marys Portland Cement Company, Limited	Toronto	May 19 "	500,000
Sakta Gold Mines, Limited	Toronto	Oct. 16 "	1,500,000
Santa Maria Mining Company, Limited	Toronto	Mar. 2 "	40,000
Scottish Ontario Gold Mining Company, Limited	Toronto	Nov. 14 "	1,500,000
Seneca Porcupine Gold Mining Company, Limited	Toronto	Nov. 3 "	1,500,000
Seneca-Superior Silver Mines, Limited	Toronto	Sept. 29 "	500,000
Smith-Vet Mines, Limited	Toronto	April 24 "	3,000,000
South-Dome Mines Limited	Toronto	April 1 "	100,000
Sovereign Porcupine Mines, Limited	Toronto	April 24 "	1,000,000
Stuart Exploration Syndicate, Limited	Toronto	May 1 "	25,000
Sun Brick Company, Limited	Toronto	Mar. 14 "	200,000
Superior Construction Company, Limited	Sault Ste. Marie.	Feb. 2 "	100,000
Superior Swastika Mines Company, Limited	Toronto	Sept. 2 "	40,000
S V. 329 Mining Company, Limited	Walkerville	Mar. 29 "	1,000,000
Teck Swastika Gold Mines, Limited	Toronto	Nov. 20 "	2,500,000
Telephone City Oil and Gas Company, Limited	Brantford	April 12 "	90,000
The Achilles Mines, Limited	Toronto	May 9 "	1,000,000
The Albemarle Zinc Company, Limited	London	Jan. 27 "	450,000
The American Gold Fields, Limited	Toronto	Mar. 29 "	2,000,000
The American Porcupine Gold Mining Company, Limited	Toronto	Sept. 9 "	1,000,000
The Butwell Brick Company, Limited	Toronto	Nov. 23 "	75,000
The Canada First Mining Company, Limited	Toronto	July 20 "	1,800,000
The Canadian Potash Company, Limited	Toronto	Aug. 5 "	40,000
The Canadian Talc and Silica Company, Limited	Madoc	Jan. 20 "	100,000
The Central Pipeline Company, Limited	Niagara Falls	May 1 "	100,000
The Chisholms Corporation, Limited	Toronto	Jan. 16 "	500,000
The Coldwater Stone Quarry and Power Company, Limited	Toronto	Oct. 13 "	100,000
The Combined Larder Mines, Limited	New Liskeard	Feb. 6 "	3,000,000
The Commonwealth Oil and Gas Company, Limited	Brantford	Feb. 9 "	300,000
The Congress Mines, Limited	Toronto	June 14 "	1,000,000
The Crescent Mining Company, Limited	Toronto	Oct. 3 "	100,000
The Crystal Oil and Gas Company, Limited	Paris	June 8 "	90,000
The Daly-Taylor Porcupine Mines, Limited	Toronto	April 4 "	1,500,000
The Digby-Dome Mines Company, Limited	Brantford	Oct. 27 "	1,500,000
The Dome Extension Mines Company, Limited	Toronto	Jan. 20 "	2,000,000
The Dominion Diamond Drilling Company, Limited	Toronto	Aug. 15 "	40,000
The Dominion Lands and Mines Development Company, Limited	Toronto	Sept. 21 "	1,000,000
The Eureka Gold Mining Company, Limited	Porcupine	April 6 "	2,000,000
The Frobel McCourt Silver Mining Company, Limited	Ottawa	April 18 "	500,000
The Gangir Talc Company, Limited	Toronto	Mar. 11 "	100,000
The Grasselli Chemical Company, Limited	Hamilton	Aug. 30 "	250,000
The Hastings Quarries, Limited	Toronto	July 19 "	100,000
The International Potash Corporation, Limited	Toronto	Aug. 5 "	40,000
The "Katy Did" Mining Company, Limited	Toronto	April 28 "	1,000,000
The King Quicksilver Mining Company, Limited	Toronto	Oct. 27 "	1,000,000
The Kingston Mica and Phosphate Company Limited	Kingston	Nov. 22 "	500,000

Table No. XVIII.—Concluded.

Name of Company.	Head Office.	Date of Incorporation.	Capital.
The Kissinger Mining Company, Limited	Fort Erie	April 11, 1911	$2,000,000
The Langmuir Nighthawk Lake Gold Mines, Limited	Toronto	Dec 5 "	50,000
The Lethbridge Brick Company, Limited	Sault Ste. Marie	Jan. 11 "	20,000
The Loyalty Silver Mining Company, Limited	Toronto	April 13 "	1,500,000
The MacMartin Porcupine Gold Mines, Limited	Porcupine	May 12 "	1,000,000
The Medina Natural Gas Company, Limited	Niagara Falls	Feb. 20 "	500,000
The Minitaki Gold Fields, Limited	Port Arthur	June 14 "	250,000
The Nash Bay Mining Company, Limited	Toronto	Feb. 7 "	1,000,000
The National Porcupine Mines, Limited	Ottawa	May 1 "	1,000,000
The Natural Gas Company of Ontario, Limited	Hamilton	Oct. 19 "	40,000
The Nokomis Oil and Gas Company, Limited	Paris	Nov. 8 "	90,000
The North-Thompson Mines, Limited	Toronto	Aug. 1 "	40,000
The Onondaga Oil and Gas Company, Limited	Brantford	Mar. 18 "	90,000
The Ontario Cobalt Twentieth-Century Mining Company, Limited.	Toronto	Mar. 8 "	40,000
The Ottawa Concrete Homes Company, Limited	Ottawa	Sept. 5 "	200,000
The Pennsylvania Mines Company, Limited	Porcupine	April 27 "	1,000 000
The Pike Lake Gold Mines, Limited	Haileybury	July 28 "	3,000,000
The Porcupine-Angus Mining Company, Limited	Windsor	Sept. 28 "	1,500,000
The Porcupine Bristol Gold Mining Company, Limited	Toronto	Aug. 23 "	2,000,000
The Porcupine Free Gold Mining Company, Limited	Ottawa	May 15 "	2,000,000
The Porcupine Miracle Mining Company, Limited	Porcupine	Mar. 18 "	1,000,000
The Porcupine Swastika Gold Mining Company, Limited	Ottawa	Mar. 6 "	200,000
The Potash Syndicate of Canada, Limited	Toronto	Aug. 5 "	40,000
The Proprietory Mines, Limited	Toronto	April 5 "	3,000,000
The Roman Gold Mines of Porcupine, Limited	Ottawa	Aug. 9 "	2,000,000
The Switzer Mining Company, Limited	Haileybury	Nov. 28 "	500,000
The Union Natural Gas Company of Canada, Limited	Niagara Falls	Dec. 19 "	3,000,000
The Western Development Company, Limited	Sarnia	Sept. 28 "	100,000
The Western Fuel Gas Company, Limited	Chatham	April 3 "	600,000
The Willcox Lake Brick Company, Limited	Toronto	June 10 "	100,000
The Willing Mining Company, Limited	Toronto	Oct. 4 "	700,000
Tilden Mines, Limited	Toronto	May 26 "	40,000
Tivani Electric Steel Company, Limited	Belleville	Dec. 20 "	20,000
Tommy Burns Gold Mines, Limited	Toronto	Sept. 5 "	100,000
Toronto Brick Company, Limited	Toronto	Sept. 13 "	600,000
Toronto Pressed Brick and Terra Cotta Company of Milton, Limited	Toronto	Nov. 24 "	300,000
Utor Gas Company, Limited	Toronto	Aug. 15 "	40,000
Victoria Porcupine Gold Mines, Limited	Porcupine	May 4 "	2,000,000
West Dome Mines, Limited	Toronto	Jan. 31 "	3,000,000
Winyah Gold Mines, Limited	Toronto	Nov. 24 "	2,500,000
Total			$215,640,000

Mining Companies Licensed in 1911.

Name of Company	Head Office.	Date of License.	Capital.
Alpha Venture Company	Toronto	July 20, 1911	$150,000
Buffalo Brockville Mining Company	Brockville	Sept. 25 "	50,000
Canadian Steel Foundries, Limited	Toronto	Mar. 16 "	2,000,000
Cannelton Coal and Coke Company	Toronto	Sept. 25 "	500,000
Cedarhurst Gold Development Company	Guelph	Mar. 3 "	40,000
Eugene Munsell and Company	Ottawa	Feb. 25 "	40,000
Porcupine Realty and Mines, Limited	Welland	Sept. 25 "	50,000
Rochester Development Company, Limited	Campbellford	June 27 "	50,000
Syracuse Exploration Company	Haileybury	April 4 "	40,000
The Alberta Land Company, Limited	Fort William	Mar. 7 "	£60,000
The British Aluminium Company, Limited	Toronto	Feb. 23 "	$10,000
The Dryden Mining Company	Dryden	Dec. 19 "	50,000
The Northern Ontario Exploration Company, Limited	Porcupine	May 2 "	£100,000
The Northern Ontario Prospecting Syndicate, Limited	Toronto	July 14 "	$20,000
The Ontario Porcupine Goldfields Development Company, Limited	Pearl Lake	Sept. 25 "	£600,000
The Poole Island Trap Rock Company	Sault Ste. Marie.	June 13 "	$10,000
The Scottish Porcupine Goldfields, Limited	Ottawa	Aug. 23 "	5,000
The Strathcona Coal and Exploration Syndicate, Limited	Fort William	Mar. 3 "	£2,100
Virginia Graphite Company	Wilberforce	April 7 "	$300,000

Mining Divisions

The Mining Divisions remain in number and boundaries the same as described in last year's Report, being eleven in all. The list of Divisions and Recorders, together with the receipts for the year at the several offices, is as follows:—

Mining Division.	Name and P.O. Address of Recorder.	Receipts.			Total receipts.
		Purchase money.	Miner's licenses and permits	Recording fees, etc.	
		$	$	$	$
Kenora	W. L. Spry, Kenora	1,049 51	815 00	1,475 00	3,369 51
Port Arthur	J. W. Morgan, Port Arthur	9.381 17	2,098 00	2,815 20	11.294 37
Sault Ste. Marie	S. T. Bowker, Sault Ste. Marie	2,595 29	1,670 00	1,232 00	5,497 29
Sudbury	C. A. Campbell, Sudbury	1,406 39	4,779 00	22,514 50	28,699 89
Montreal River	A. Skill, Elk Lake	9.225 33	2,241 00	1,998 00	13,464 33
Gowganda	H. E. Sheppard, Gowganda	3,078 19	3,314 00	4,781 40	11,173 59
Temiskaming	G. T. Smith, Haileybury	12,989 46	17.779 00	13,580 25	44.348 71
Larder Lake	J. A. Hough, Matheson	4,724 27	1,317 00	12,275 25	18.316 52
Parry Sound	H. F. McQuire, Parry Sound	50 00	304 00	263 00	617 00
Porcupine	A. E. D. Bruce, Porcupine	10,107 33	15,931 80	62,503 85	88,542 98
Coleman	G. T. Smith, Haileybury	332 60	213 00	76 00	621 60
	Totals	54.969 54	50.461 80	123,514 45	228,945 79

The remainder of the revenue for the year was remitted direct by the parties concerned to the Department at Toronto.

Brief reports from the several Recorders for the year are appended:—

Kenora

Recorder, W. L. Spry.—Miner's licenses issued, 80; renewals, 84; certificates of performance of working conditions, 102; certificates of record, 20; applications for mining claims, 89; applications recorded, 73; applications refused, 3; claims cancelled, 21; transfers recorded, 40; partnership agreement recorded, 1; agreement recorded, 1; penalty reports of work filed, 2; extensions of time granted, 7; appeal from decision of Mining Commissioner, 1.

With regard to the mining industry, Mr. Spry states that a large amount of assessment and development work was done on claims in the Division during the year, but the expected revival of gold mining on a large scale did not take place.

Port Arthur

Recorder, J. W. Morgan.—Miner's licenses issued, 206; renewals, 320; claims recorded, 183; claims cancelled, 96, many of the latter being restaked.

The Recorder notes that the St. Anthony gold mine at Sturgeon lake had been reopened and that excellent results were being obtained by the new management. Much work had been done on other properties near the St. Anthony, and a good deal of ore blocked out. No new mining territory had been opened up by prospectors during the year, notwithstanding the existence of large areas in the Division which have never been prospected. The new line of the Canadian Northern railway, under construction from Port Arthur to Sudbury, would doubtless facilitate the exploration of the region traversed by it.

Sault Ste. Marie

Recorder, S. T. Bowker.—Miner's licenses issued, 152; renewals, 200; claims recorded, 119; claims cancelled, 50.

Sudbury

Recorder, C. A. Campbell.—Miner's licenses issued, 517; renewals, 509; claims recorded, 2,309.

Mr. Campbell adds that few, if any, claims were staked for silver in his Division during the year, interest in this metal having for the time being subsided. There was, however, much activity in taking up claims for gold in the earlier part of the year, south of Musgrove and Bartlett townships, round Muskasenda lake and west of Pharand township and Kenogaming lake. Later, reports of finding free gold at West Shining Tree lake brought in a large number of prospectors, and resulted in the staking out of a considerable portion of four townships, namely, Churchill, Asquith, Fawcett and McMurchy. About the same time there was some staking done round Groundhog lake, along the line of the Canadian Northern railway, and a few miles north. West of Sudbury, some claims were staked at Schist lake, a small lake near Opeepesway, also in Davis and Parkin townships to the east. Some interest was taken in nickel and iron, and one claim was staked for cinnabar, said to have been discovered by an Indian named Commando on an island in the Groundhog river, south of Bremner island, and about eight miles north of the Transcontinental railway.

Montreal River

Recorder, Albert Skill, Elk Lake.—Miner's licenses issued, 81; renewals, 285; claims recorded, 98; certificates of work granted, 126; certificates of record granted, 42.

Mr. Skill remarks that 1911 was a " lean " year in his Division, there being little activity compared with former years. Most claims already located, however, were protected by performance of the working conditions. Actual mining work, as distinct from assessment work, was confined to a few properties, the principal of which were the Moose Horn, Donaldson, Barnet, Paragon and Cobalt Frontenac, the last-named company mining for gold in the township of Tudhope. At the Hitchcock property (silver) in the same township a new 6-drill plant was installed, and it was proposed to carry on work extensively during the summer of 1912. The prospects of railway extension into Elk lake were favorably affecting the future of the district.

Gowganda

Recorder, Harry E. Sheppard.—Miner's licenses issued, 270; renewals, 310; certificates of work issued, 185; certificates of record issued, 31; claims recorded, 258; claims cancelled, 165.

With respect to actual mining in his Division, Mr. Sheppard reports that the year was marked by the finding and mining of valuable bodies of silver ore. The market for mediocre claims was and continues very dull. The discovery of rich ore in the diabase on the Millerett Mining Company's property created a favorable sentiment with regard to the possibilities of the diabase at depth. Good finds were also made at some depth at the Calcite lake and Canadian Gowganda prospects. In the latter part of the year the Mann Company, long idle, discovered a new ore body at the surface. About a carload of ore was mined, and a force of 20 men employed. Other companies operating were:—Miller Lake-O'Brien at Miller lake; Powerful and Bishop at Calcite lake; Gamey-Thompson at Spawning lake; Hudson Bay, south of Hanging Stone lake; M. J. Foley, Eplett-Caswell, McIntosh, Shining Tree lake; Homestake, Obushkong lake. The Willans prospect on the east branch of the Montreal river had recently changed hands, and the purchasers with a gang of men were preparing for mining operations. Altogether, these companies had from 300 to 350 men under employment. A great deal of assessment work on mining claims was done during the year, the owners in many cases completing the same and taking out a Crown lease.

Temiskaming

Recorder, George T. Smith.—Miner's licenses issued, 1,042; renewals, 2,054; claims recorded, 922.

Mr. Smith makes these comments:—In view of the fact that a great number of the old-time prospectors and mining men, with headquarters at Cobalt, Haileybury and New Liskeard, are deeply interested in the Porcupine and Sudbury Mining Divisions, and that a considerable portion of this Divison was transferred to that of Larder Lake, it is not to be wondered at that the volume of business transacted in the Temiskaming Mining Division during the past year was somewhat smaller than usual. In South

Lorrain and the Metabitchewan area, largely on account of the difficulty of interesting prospective purchasers in silver properties, very little more than the actual amount of development work necessary to maintain mining claims in good standing was performed, and several promising properties, on which all the necessary work had been done, and which might with a reasonable outlay have been added to the list of shippers, were allowed to remain idle. A comparatively small number of the claims, however, were allowed to lapse for non-performance of work. Considerable development work was done in the township of Bryce; the Casey Cobalt mine in Casey township was steadily worked with satisfactory results; there was a revival of interest and two new mining plants installed in the Portage Bay district, and the Green-Meehan mine in Bucke township was again in operation.

Larder Lake

Recorder, John Atwell Hough.—Miner's licenses issued, 203; renewals, 100; claims recorded, 1,252; transfers recorded, 421; certificates of work issued, 149; certificates of record issued, 93.

Recorder Hough states that there was much activity in his Division during the year. There are excellent showings of gold in the Swastika area, and many claims were staked out there. Machinery has been installed on some of the most promising claims and shafts are now being sunk. At Larder lake a number of claims were taken up, and it was reported that the Reddick Company had struck their ore body at the 100-foot level, where it was 20 feet wide, showing free gold. The development of the water power at Raven river was nearly completed, and a power line ten miles in length erected to connect with the Harris-Maxwell property (Goldfields Limited), where a 40-stamp mill is being erected. Some activity was shown in Munro, Guibord and Beatty townships, and a little gold produced. There are in this locality nice showings of free gold. Work was resumed on the nickel properties in the townships of Dundonald and Clergue, and the intention was to ship the ore. The ore body is said to have been traced for 900 feet with an average width of seventeen feet.

Parry Sound

Recorder, H. F. McQuire.—Miner's licenses issued, 25; renewals, 42; claims recorded, 15; claims cancelled, 157.

Mr. McQuire reports the mica properties in the township of McConkey to be promising. The samples shown are good, and development work on the claims is being kept up. Some progress was made in proving the iron ore locations in the township of Lount. The Hamilton Steel Company had an option on a number of the claims, and at the end of the year had a core drill at work which was said to be in ore at a depth of 25 feet.

Porcupine

Recorder, A. E. D. Bruce.—Miner's licenses issued, 1,240; renewals, 743; claims recorded, 3,756.

Under date of 24th January, 1912, Mr. Bruce writes:—The early part of 1911 was a season of marked activity and continued so until the great fire of July 11th., after which prospecting dropped off. The mill at the Dome mine is nearing completion, and all the buildings now being put up are substantial structures of brick and concrete. The Hollinger mill is also being rushed to completion, but it will be some little time before the machinery is installed. The power plant at Sandy Falls on the Mattagami river is completed and is supplying the mines and town with electric light and power. Free gold showings on the surface in the township of Geikie were attracting some attention. The Temiskaming and Northern Ontario railway will soon be opened to Timmins. The railway service in the camp was excellent. A large amount of mining development is in progress.

Coleman

On 10th January, 1911, the Mining Recorder's Office at Cobalt was abolished, and the special Mining Division of Coleman was transferred to the charge of Mr. G. T. Smith, Mining Recorder at Haileybury.

Provincial Assay Office

Mr. N. L. Turner, Provincial Assayer, reports as follows for the year 1911:—

The Provincial Assay Office was established in the city of Belleville in 1898 as an aid to geologists, mining engineers, prospectors and all others interested in the mineral development of the Province of Ontario. The work of the office has never been confined to Ontario only, as samples are received from all parts of Canada and also from parts of the United States.

The fees for examinations and assays have been kept at practically cost, and in fact in some cases less. All samples that are brought to the office personally are examined and identified free of charge.

During the latter part of 1910, it was decided to move the office from Belleville to Toronto in order to make it more central. The necessary building was procured at number 5 Queen's Park, and in November, 1911, the change was made. This change naturally interfered somewhat with the work of the office, and as a consequence a number of samples had to be kept over until 1912. For this reason, the total number of samples assayed is less than in previous years.

The new offices are in a fine, commodious building, part of which is used for laboratory purposes by the Provincial Board of Health. The laboratories are connected with a central ventilating fan, which affords excellent ventilation for all the rooms. The lack of this was one of the chief drawbacks to the Belleville office.

The fittings and equipment are all practically new and up to date, so that the office is now probably one of the finest in the Province.

The grinding room is equipped with a 5-horse power electric motor which drives the crushers, grinders, air compressor, blower for the assay furnace and a direct current dynamo for charging storage batteries.

The fire room has a new gas muffle furnace manufactured by the Rockwell Furnace Company of New York, and all the other necessary appliances.

The wet laboratory is supplied with hot and cold water, compressed air, suction, gas and electric light. Particular attention has been paid to the ventilation of this room, and the system installed is proving very satisfactory. This laboratory has all the necessary equipment of a first-class office, including drying ovens, water still, titrating table, etc. A fine large fume cupboard divided into two sections is one of the features of this room.

A room has been set aside for electro-chemical analysis, and at the time of writing is being fitted up with necessary storage battery, switchboard, meters, etc. It is the intention to make all copper, nickel, cobalt, lead and most of the silver determinations by electro-chemical methods.

The balance-room has a new Teoemer analytical balance, a button balance, and the necessary pulp balances.

There is also a private office and library, and the necessary store-rooms.

During the past year 644 samples were examined and reported on. This number is less than in previous years, owing to the fact that the work had to be curtailed during the months of November and December, and a large number of samples carried over to 1912. They will appear in the report for that year.

The work of the office during the past year consisted of:—

(1) The examination and assaying of samples received from mining engineers, geologists, prospectors and the public generally. This covered a wide range of work, as all kinds of minerals were sent in for examination and assay.

(2) The analysis of samples of rock for the various geologists of the Bureau of Mines.

(3) The sampling of car lots of cobalt-silver ore shipped from the mines upon which the Government collects a royalty. This necessitated having a sampler at Deloro, Copper Cliff and Thorold for a large portion of his time. Mr. T. E. Rothwell attended to this work.

(4) The assaying and valuating of these car lots of ore required considerable time.

During the coming year it is the intention of the chemist in charge to direct investigations along different lines, such as the occurrence of mercury at Cobalt, of tungsten ores at Porcupine, etc. The results of these investigations will be published from time to time.

The following is a list of the fees for the more common assays and determinations; others will be furnished on application.

Price List for assays (each checked off by a duplicate):—

Gold and Silver Ores	For one Sample	For 3 to 5 Samples at one Time Each	For 6 or more Samples at one Time Each
Gold by fire method	$1 00	$0 90	$0 75
Silver by fire method	1 00	0 90	0 75
Gold and silver by fire method	1 25	1 00	0 90
Gold by amalgamation assay for free gold	2 00	1 80	1 50

For amalgamation assay of gold ore at least 5 lbs. of ore must be sent.

The following tests are recommended along with the amalgamation assay: Fire assay of the ore to see how results obtained check off with the amalgamation assay; panning down of ore to obtain concentrates; and fire assay of concentrates; also fire assay of tailings.

The laboratory is also prepared to do cyanide assays on raw ore, tailings, concentrates, etc., with amalgamation tests and fire assays where needed. Not more than 50 lbs. of ore can be treated.

Check Assays.—The laboratory makes a specialty of check assay work on gold ores. Samples sent in for check assays must be crushed at least 5 or 10 mesh, especially in the case of gold ores variable in richness. At least 12 ounces of the pulp must be sent for assay. A sample consisting of a single piece of ore, however large, is practically of little value in testing a deposit, and in no case suitable for check assay. Two pieces of gold ore taken from the same spot in a deposit will not necessarily give the same values on assay. The amalgamation assay for gold with fire assay of concentrates and tailings is recommended for gold ores either in the rough or pulped containing coarse free gold, as the fire assay alone will give variable results.

The most satisfactory method of checking results is to mix ore pulp and divide the pulp into two equal parts, sending the separate lots to this laboratory with different marks.

Each determination made in the laboratory is checked off by a duplicate when sufficient ore is sent, thus reducing errors to minimum. The pulp of each sample is retained for future reference.

Miscellaneous Assays.

Copper by fire assay method	$1 25	$1 00	$0 90
Copper by cyanide method	1 25	1 00	0 90
Copper by electrolytic method	1 25	1 00	0 90
Lead by titration method	1 25	1 00	0 90
Zinc by titration method	2 00	1 80	1 50
Nickel by electrolytic method	3 00	2 70	2 25
Platinum by fire assay method	2 00	1 80	1 50
Cobalt by electrolytic method	3 00	2 70	2 25
Arsenic by titration method	2 00	1 80	1 50
Manganese by titration method	3 00	2 70	2 25
Chromium by titration method	3 00	2 70	2 25
Antimony by titration method	2 00	1 80	1 50
Bismuth by titration method	2 00	1 80	1 50
Iron (metallic) by titration method	0 50	0 45	0 30
Molybdenum by titration method	2 00	1 80	1 50
Tin fire assay by titration method	2 00	1 80	1 55

Reduction of Fees.—A reduction of 15 per cent. on the total is allowed on 6 or more assays on one sample and 20 per cent. on 10 or more assays on one sample.

Fees for Qualitative Examination.—Not equivalent to an assay or analytical determination, only showing the presence or absence of certain constituents, no values of percentages given.

Iron	$0 25	Platinum	$1 00
Copper	0 25	Arsenic	0 50
Nickel	1 00	Bismuth	0 50
Cobalt	1 00	Molybdenum	0 50
Zinc	0 50	Lime	0 50
Lead	0 50	Magnesia	0 50
Chromium	1 00	Alumina	0 50
Manganese	1 00		

Complete qualitative examination of any sample, $8.00; other constituents at same rates.

Identification of mineral samples, that is, determination of the constituents that may be determined by inspection, field tests, blow pipe or rough qualitative examination, is done by the laboratory at a nominal charge of 50 cents per sample; three or more samples at one time, 40 cents each.

This also includes a report as to the probable commercial value of the sample.

Samples for identification must be sent in a rough state, *i.e.*, not pulverized. Samples for identification will be reported on free of charge, if brought to the laboratory by parties desiring such reports.

Directions for Sending Samples.—Crushed samples, representing the average of large quantities, or samples less than 5 lbs. in weight, may be sent by mail as 3rd class matter (2 cents for first 4 ounces or fraction thereof, and 1 cent for each additional 2 ounces). Write your own name and address plainly on the parcel and send instructions with money in payment of fees in a separate letter. When more than one sample is sent at one time, each sample must be distinctly marked or numbered, so that they may be identified by instructions in letter. Samples may be sent per express, charges prepaid.

Sample bags addressed to this laboratory for sending ore pulp by mail may be obtained free on application; also canvas bags for shipping ore.

Each determination made in the laboratory is checked off by a duplicate when sufficient material is sent, thus reducing errors to a minimum. The pulp of each sample is retained for future reference, subject to order of sender.

Terms.—Money in payment of fees sent by registered letter, post office order, postal note, express order, etc. must invariably accompany samples in order to insure prompt return of certificates, which are not sent until fees are paid in full.

MINING ACCIDENTS IN 1911

By E. T. CORKILL, Chief Inspector of Mines.

During the year 1911 in and about the mines regulated by the Mining Act of Ontario there were 33 fatal accidents which caused the death of 36 men. The fatalities below ground numbered 33, and above ground 3. Altogether, at the mines, metallurgical works and quarries regulated by the Mining Act there were 45 fatal accidents, causing the death of 49 men, an increase of 1 over the number killed in 1910. The accidents at metallurgical works and quarries are separated in this report from the accidents at the mines, and are set out in tables following those for the mine accidents. In former reports of the Bureau of Mines all the accidents have been included in the one table, and this should be taken into consideration in comparing the accidents for 1911 with those of previous years.

The total number of serious accidents in the mines of Ontario reported to the Bureau of Mines was 111, resulting in 36 men killed and 86 injured. Of these accidents 82 occurred below ground and 29 above ground. The fatal accidents took place in mines operated by 21 different companies.

At the metallurgical works there were 33 accidents which caused the death of 9 and serious injuries to 25 men.

The number of accidents therefore at mines and works regulated by the Mining Act of Ontario is 144, causing the death of 49 men and serious injuries to 111 men. Of the men seriously injured, 60 received their injuries below ground and 51 above ground.

A "serious" accident is not defined by statute, but is here taken to mean an accident by which a man is incapacitated for work for more than seven days.

Investigation and report were made in 30 out of the 33 fatal accidents in the mines, in 6 out of 9 fatal accidents at the metallurgical works, and in all the quarry accidents. In accordance with the requirements of the Mining Act, inquests were held on most of the men killed; and to assist in bringing out the facts, were attended by either the Inspector or the writer. In a few instances, through the lack of knowledge on the part of the Coroner as to the law requiring an inquest, none was held. An investigation in such cases was made by the Inspector or the writer, and the evidence of witnesses taken under oath.

Analysis of Fatalities

By months the 36 fatalities occurred as follows:—January, 6; February, 1; March, 6; April, 0; May, 3; June, 4; July, 0; August, 0; September, 3; October, 2; November, 4; December, 7; total—36.

A comparison of the causes of the fatalities at the mines for 1910 and 1911 is as follows:—

	1910. Per cent.	1911. Per cent.
Falls of ground	19.0	5.5
Shaft accidents	21.6	22.2
Explosives	27.0	44.5
Miscellaneous (underground)	8.1	19.5
Surface	24.3	8.3

These figures show a marked decrease in the accidents from falls of ground and in surface accidents, but a large increase in those caused by explosives.

There were employed at the producing and non-producing mines during 1911 approximately 9,423 men. At these mines 36 men were killed, which is equivalent to 3.82 per 1,000 men employed.

Table of Fatal Accidents in Mines, Metallurgical Works and Quarries, 1900 to 1911.

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	Total
Persons killed in producing and non-producing mines	17	13	10	7	7	9	11	22	47	49	48	49	289
Persons employed in producing mines	3,330	4,135	4,426	3,499	3,475	4,415	5,017	6,305	7,435	8,595	10,862	12,543	73,847
Persons employed in non-producing mines (estimated)..	650	550	450	400	400	500	750	1,140	1,750	2.000	2.000	2,000	12.590
Total persons employed.........	3,980	4,685	4,876	3,899	3,875	4,915	5,767	7,345	9.185	10.505	12.862	14,543	86,437
Fatal accidents per 1,000 employed......................	4.27	2.77	2.05	1.79	1.80	1.83	1.96	2.99	5.11	4.66	3.73	3.37	3.34

The following classification distributes the responsibility for the cause of the fatalities at the mines:—

1.	Fatalities due to danger inherent to the work itself..................	10 or 27.8 per cent
2.	" arising out of defects in the mine workings	10 or 27.8 "
3.	" due to fault of fellow workmen	2 or 5.5 "
4.	" due to fault of injured person............................	14 or 38.9 "

The specific occupation in the mine of the men who were killed, and their nationality, are shown in the following table:—

Occupation	English Speaking	Polander	Finlander	Italian	French	Hungarian	Austrian	Total
Drill runner	5	1	7		1		1	15
Trammer..............................		4				1		5
Drill helper..........................		2	2	1	1			6
Bucket or Cage tender................		1		1				2
Laborer	1			1				2
Shift boss	1			1				2
Powderman	1						1	2
Deckman	1							1
Hammerman............................					1			1
Total..........................	9	8	9	4	3	1	2	36

The ages of the men killed at the mines were as follows:—

17 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	56 to 60	Unknown	Total
2	15	5	7	4	1	1	1	36

Cause and Place of Fatalities in Mines

The following schedule shows the cause and place of the fatalities in 1911 compared with 1910:—

Below ground:		1911.	1910.
Falls of ground		2	7
Shaft accidents:—			
Falling from bucket	3		
Falling down shaft	3		
Objects falling down shaft	1		
Falling down shaft due to staging giving way	1		
	—	8	8
Explosive Accidents:—			
Premature explosion while loading or lighting holes	5		
Drilling into bottom ot old or missed holes	3		
Explosion of box of dynamite while preparing charges	3		
Asphyxiation from gases from explosives	3		
Picking or putting bar into old hole containing explosive.	2		
	—	16	10
Miscellaneous accidents:—			
Falling down chute	3		
Struck by steel, etc., falling down stope or from staging.	3		
Falling down stope	1		
	—	7	3
Above ground:—			
Blowing up of thawing house	2		
Crushed under falling material	1		
	—	3	9
Total		36	37

Cause and Place of Non-Fatal Accidents at Mines

The following schedule shows the cause and place of the non-fatal accidents in 1911 at the mines, and the number injured:—

Underground:—		
Falls of ground		4
Shaft accidents:—		
Cage accidents	4	
Bucket accidents	1	
Falling part way down shaft	3	
Objects falling down shaft	1	
	—	9
Explosives:—		
Drilling into old or missed holes	8	
Picking or putting bar into old hole	1	
Premature explosion	1	
	—	10

Miscellaneous accidents:—		
Falling down stopes, raises, winzes, chutes or man-ways	8	
Jammed by cars, skips or buckets	8	
Scaling	4	
Falling from staging	3	
Foreign material in eyes	2	
Fall of rock or ore from chutes	8	
Burned	2	
Flying rock	1	
Rock rolling down muck pile	1	
	—	37
Surface:—		
Falling from elevated places	11	
Caught by machinery	3	
Falling objects	4	
Explosives	2	
Caving of trench on rock pile	2	
Foreign material in eye	2	
Coupling cars	1	
Burned	1	
	—	26
		—
Total		86

The table giving the details of the above accidents will be found following the table of fatal accidents.

Mining Regulations and How Observed

There is much room for improvement in observing the mining regulations in Ontario both by managers and men. By referring to the classification distributing the responsibility for the cause of the fatalities it is seen that 72.2 per cent. were due to carelessness, neglect or foolhardiness on the part either of the mine management or the workmen themselves. This does not mean that all these fatalities were due to non-observance of the mining regulations; in fact only about 25 per cent. were due to direct infringement of the Mining Act. The other 47 per cent. were due mainly to dangerous mining practice, foolhardy methods or carelessness in performing the work.

Negligence has been shown by mine managers in carrying out the regulations in respect of the following:—

1. The erection and maintenance of approved thawing houses.
2. The installation of safety cross-heads.
3. The proper and efficient scaling of the roof and walls of working stopes, shafts, drifts and cross-cuts.
4. The forbidding of riding in buckets and skips.
5. Maintaining auxiliary ladders in the shaft while sinking.
6. The proper ventilation of underground workings.
7. The enforcement of the provisions regarding the blasting of missed holes, and forbidding drilling into bottoms of holes that have been blasted.

Failure to strictly observe the regulations provided for the above matters has been a prolific cause of accident.

The provisions that are most frequently broken by the workmen have reference to:—

1. Proper care in the handling of explosives.
2. Drilling into missed or cut-off holes.
3. Drilling into the bottom of old holes that have been blasted.

4. The tamping of holes after charging.
5. Riding in buckets or skips.
6. Keeping in position guard-rails around the shaft openings.
7. Proper scaling of walls and roof of working places.

These provisions are sometimes wilfully disobeyed by the workmen, and at other times broken through ignorance, carelessness and neglect. The violation of each is responsible every year for serious and often fatal accidents. The Mining Act makes provision for the reporting of careless acts to the Inspector of Mines by mine managers. Very few cases are ever reported, however, until an accident occurs, when the manager is only too anxious to place the blame on the workman. The proper time for reporting these careless practices is the first time a man is found guilty. When not reported, the manager assumes the responsibility along with the workman.

A dangerous practice that has resulted in serious and fatal accidents is the placing of men to work over other workmen in such a position that a careless act on the part of the workmen above imperils the safety of the men working below. This practice is most dangerous and should never be allowed under any circumstances.

The following notes briefly describe the fatal accidents at the mines from the several causes, and the methods that should be adopted for their prevention.

Falls of Ground

There was a marked decrease in the number of fatalities from this cause, there being only two men killed in 1911 compared with 7 in 1910. One of these men was killed by deliberately walking under a piece of ground that another man was endeavoring to take down, and when directly under it the piece fell. The other man was killed by being struck by a piece of ore falling a distance of about 30 feet. The roof of the stope had been examined and scaled on the day of the accident, but the scaling must have been poorly done. It is necessary to emphasize again the need of constant watchfulness on the part of the shift bosses over the scaling operations of the workmen. Only unceasing vigilance will prevent accidents from this cause.

Shaft Accidents

There were eight fatalities in shafts in 1911, being the same number as in 1910. The accidents, however, resulted from different causes.

Three men lost their lives through falling from buckets. Of these, two were the result of an infringement of the Mining Act.

One man in a Porcupine mine was riding up in the bucket when in some manner he fell from it and was killed. This was a direct violation of the Act, and a prosecution would have followed, but the Porcupine fire occurred just at the time, and action, under the circumstances, was deferred.

Another man was riding down in the bucket when the cross-head stuck, and after the bucket had descended about 120 feet, the cross-head dropped and the man fell to the bottom of the shaft. The company were prosecuted for maintaining a cross-head in the shaft not in accordance with the Mining Act.

Another man fell from the bucket, due to its upsetting with him. It was not ascertained how the lug holding the bucket upright became unfastened. To guard against this type of accident it would be safer to have a fastener on each side of the bucket for holding it in position.

Three men were killed by falling with car down the shaft. In two of the cases the man pushed the car into the shaft entrance while the cage or door was not in proper position. If the guard-rails around the shaft entrance were always kept in proper position, except when actually taking the car off or putting it on the cage, such accidents would not occur. The third man was apparently leaning over the shaft to see if the cage was coming and lost his balance, pulling the car into the shaft after him. This was another accident that would have been prevented if the guard had been kept in its proper position.

One man was killed by being struck by a rock falling from some place in the shaft. A round of holes was blasted in a shaft about 100 feet distant from the shaft in which this man was at work. Apparently the concussion from the blast caused the rock to fall either from the wall or from the timbers on which it may have been lodged. Blasting should not be done in such close proximity to where men are working. Another met his death through a staging on which he was working giving way and causing him to fall to the bottom of the shaft. This accident was due to carelessness in putting up the staging.

All the above shaft accidents were preventible if the Mining Act had been obeyed and proper care had been exercised in carrying out the work.

There were no fatal cage accidents in 1911. The type of cage used in the mines of Ontario is, however, not satisfactory, and accidents are liable to occur, due to the sides of the cage being so open. It is advisable that the type of cage outlined in the last report of the Bureau of Mines should be adopted. Another safeguard for shafts is the automatic gate, which can only be opened while the cage is at the level.

The safety cross-head illustrated in the Twentieth Report of the Bureau of Mines has been found to work satisfactorily wherever installed, and has no doubt reduced the number of accidents due to the sticking in the shaft of the old style of cross-head

Explosive Accidents

There were 16 fatalities resulting from the use of explosives underground and 2 on the surface, a total of 18 men killed. There were 36 men in all killed at the mines, so that explosives were responsible for 50 per cent. of the fatalities. In 1910 there were 10 men killed by explosives at the mines, or 27 per cent. of the total number killed. It is, therefore, evident that there has been an increase of nearly 100 per cent. in the fatalities from this cause.

This condition is a matter for regret and also for censure when, on an analysis of the fatalities, we find that at least half of the accidents was the result of carelessness. In the greater number of accidents from explosives there are generally only two factors. The first is the condition of the explosive, and the second the care with which it is handled. The first cause is one over which the Inspector of Mines has but little control, and has no facilities for acquiring such control. There has never been in Canada any legislation dealing with the inspection of explosives, which is a matter coming within the jurisdiction of the Federal government. At present anyone who has a substance that will explode may sell it, if he can get a buyer. Before the quality of the explosive is proven accidents may result. It is not only the small dealer who needs inspection, but also the large producers. In the competition for making sales and the desire for large profits, the grade of the explosive may not be kept up to the standard. Improper mixing, improper proportion of ingredients, improper packing, all tend to render the explosive unsafe and to increase the accident rate. Old explosives that have been in storage for more than a year are sometimes shipped into the less accessible camps in the winter time, and have to be used by the mining companies during the summer, as no others can be obtained. When an accident occurs now from an explosive, there is no way by which this explosive may be thoroughly tested, to ascertain wherein the fault lies.

Careless handling of explosives is a factor for the prevention of which the Mining Act contains certain regulations. The mine foremen and the mine managers are the men most closely in touch with this phase. They are supposed to see that the men use care in all their work pertaining to mining. The large accident list goes to show that they do not at all times fulfil their duties satisfactorily. It would seem that a number of men are employed in Ontario, handling explosives, who are totally unfitted for their work. A man may be discharged from one mine for incompetence and carelessness, but he obtains work at an adjoining mine and goes on as before. A careless workman should never be allowed near explosives, to say nothing of handling them.

Of the 5 men who lost their lives through premature explosions, 3 were killed while lighting a round of holes entirely untamped. The explosion was caused by fire from the lighted fuse igniting the exposed explosive in the hole. Accidents from this cause are preventible, and are due to the negligence and carelessness of the men, and also of their superiors, who should take precautions to see that the men do this work properly. The other two men were killed while loading holes. No explanation of the cause of the accidents could be given. It is possible that they were due to the explosive used being inferior.

Three men were killed as a result of drilling into old or missed holes. Two of these men purposely drilled into the bottoms of old holes, that had been blasted but did not break properly, with the idea of deepening the holes a little. There was some explosive left in the bottom of the hole, and as a result the men were killed. This practice is strictly forbidden by the Mining Act, and is one of the most dangerous and foolhardy of the careless practices indulged in around the mines. The other man was killed as a result of drilling into a missed hole. The missed hole was a lifting hole in a cross-cut, and could easily have been found if the drill runner had been careful. He started the new hole about 10 inches from the collar of the missed hole, and at an angle to it. After drilling a couple of feet he drilled into the missed hole, causing an explosion which killed his helper.

Three men were killed in one accident through the premature explosion of a box of dynamite that had been brought into the mine preparatory to loading a round of holes in the shaft. No cause for this explosion was found, as all the witnesses were killed, and it was impossible to ascertain just what the men were doing when the explosion occurred.

Three men lost their lives through being overcome with the gases emanating from the discharge of a round of explosives. Two of these men were shift bosses who went to the part of the mine where blasting had been done, and where none of the men were working. They were overcome by the gases and were dead when found. In connection with these two accidents it was found that the gases had been allowed to remain for some hours without turning on the air to blow them out. It is essential to allow the air to blow into the working face after a round has been blasted, whether the men are to return to work in that place the next shift or not. After these gases cool and settle they are much more deadly than immediately after the blasting. The other man was asphyxiated in a winze. Owing to there not being sufficient air to hoist the men from the winze after the round of holes had been lighted, one of them was unable to reach a place of safety, and, after the blasting, was overcome by the gases and was dead before he could be taken out. The mining company and the foreman in this case were prosecuted under the Mining Act by the Inspector of Mines for not maintaining an auxiliary ladder in the winze. The former was fined $100 and costs, and the latter $50 and costs.

Two other men lost their lives through striking explosives with a bar. In one case the explosive was in a cut-off hole, and in the other it was either an old hole containing an explosive or some explosive in the muck. In the first case it was impossible to understand why the workman did not see the cut-off hole, and it was due to lack of proper inspection that the accident occurred. In the second case the man was using his bar in a pile of rock cleaning off a bench in order to set up the drill. It is therefore quite probable that even a close inspection would not have disclosed the presence of the explosive.

Thawing House Explosions

Two thawing houses blew up during the year, causing in each case the death of the powderman. In one case it was proved that the powderman had a lighted candle in the thawing house, which no doubt caused the explosion. In the other case it was impossible to find any cause for the explosion. The thawing house was, when inspected two months before the explosion, in very good condition, with a satisfactory heating arrangement.

It is necessary to emphasize the following points that should be observed in the construction of a safe and efficient thawing house:—

1. It should be built of such materials that in case of an explosion, there will be the smallest number of pieces to be projected any distance.
2. The heating arrangements should be by means of hot water or steam circulating in pipes.
3. These heating pipes must be so arranged that no explosives can be placed or accidentally fall on them.
4. The racks should be so placed that they are some distance away from the heating pipes.
5. These racks should be thoroughly cleaned and washed at least once a month.
6. The house should be constructed with an ante-room opening into the room in which the explosives are thawed. This will guard against a sudden change in the temperature of the thawing room.
7. The thawing room should be maintained at as uniform a temperature as possible and a recording thermometer kept therein.
8. A proper ventilator which can be opened or closed should be built in the roof of the house.
9. A separate building should be constructed in which to prepare the exploders.
10. No caps or fuse should be kept in the thawing house.
11. A wooden or copper wedge should be used for opening the boxes of explosives.
12. A competent man should be placed in charge of the thawing house, and no other person allowed to enter it.
13. A proper system of lighting should be installed, and a naked light never allowed near the building.
14. The powderman should never carry matches or tobacco while on duty.

Miscellaneous Accidents

There were 7 men killed in miscellaneous accidents underground. Of these 6 were killed in stopes and 1 in a drift.

Three of the fatalities were the result of men falling into the ore chutes from the stopes. The mouths of chutes in stopes are hard to keep guarded at all times, owing to the blasting. They should, however, be covered with timbers at all times except when actually in use. In one of the cases the ore had hung up in the chute, and the man was up on it trying to drive an iron pipe through in order to start the ore running. It loosened unexpectedly, and the workman was drawn down by the ore and smothered.

Three other men lost their lives through being struck by objects falling from above them. One of these men was struck by a hammer-drill which fell from the staging, due to the breaking of the steel. The staging was about 6 feet above the floor of the drift, and the man killed was standing about 8 feet from the end of the staging.

The other two men were killed by being struck with drill-steel. In one case, and probably in the other, the steel fell down the stope from where the machine men were working. These machine men were set to work on a bench of the underhand stope, which was in such a position relative to the trammer that anything falling from the bench would in all probability strike the trammers, unless they heard it coming and ran to a place of safety. Such a practice is very dangerous, and should never be followed. One man slipped while taking down the tripod for the drill and fell to the bench, 12 feet below, and was killed.

Surface Accidents

Three men were killed on the surface about the mines. Of these, two were killed by the blowing up of thawing houses. This matter has been discussed under a previous heading. The other man was at work piling up pieces of shafting. One end of the shafting was on a brace about 2 feet above the ground. The man slipped and fell with his head under the shafting; at the same time the brace gave way, allowing the shafting to fall on the man, killing him instantly.

Prosecutions

The following cases of prosecution for infringement of the Mining Act were undertaken by the Inspector of Mines:—

1. One company were fined $100 and costs for a violation of sec. 164, rule 23, of the Mining Act, in not maintaining an auxiliary ladder in the winze while sinking was in progress.

2. The foreman of the above company was fined $50 and costs for the same offence as No. 1.

3. The manager of a second company was fined $100 and costs for a violation of sec. 164, rule 19, of the Mining Act, in not maintaining guard rails at the collar of the shaft.

4. A third company were fined $100 and costs for a violation of sec. 164, rule 24a, of the Mining Act, in not maintaining a safety cross-head so constructed that it cannot stick in the shaft without also stopping the bucket.

Porcupine Fire

A most disastrous fire swept over the Porcupine camp in July, causing the death of 71 persons and the loss of thousands of dollars in camp buildings and equipment. The largest loss of life occurred in the West Dome shaft, where some 34 persons took refuge from the fire. This shaft was about 80 feet in depth, with no auxiliary exit. The timbers took fire at the collar of the shaft, and were burned to a depth of about 30 feet. As a result all in the shaft were suffocated. Several other persons were suffocated in the Dome shaft, where they had taken refuge. This is a startling example of the danger of erecting buildings too near the shaft when there is but one entrance to the mine. It also proves the necessity for securing an auxiliary exit as soon as possible. The location for magazines for explosives in a wooded country is also a difficult problem on account of the danger from fire. Frequently sufficient care is not taken in cleaning up around these magazines, or in their method of construction.

Health of Miners

There was no marked outbreak of disease among the miners during the year. A little typhoid was present in nearly all the northern Ontario camps. The question of providing sanitary camps and a proper water supply does not receive sufficient attention until an outbreak of disease compels the companies to look after it. The overcrowding of the bunk houses in our newer camps is also to be condemned. There is not sufficient care shown in providing a properly equipped dry house, in which the men working underground can change their clothing when coming off shift. This is specially necessary in Ontario in the winter time on account of the very cold climate.

Mine Hospitals

The mine hospital at Cobalt has done efficient work throughout the year. Mr. Tom R. Jones has again been elected president of the board. All the operating mining companies in the Cobalt camp are now subscribers to the hospital.

The Canadian Copper Company's hospital at Copper Cliff has also done good service throughout the year in taking care of the sick and injured employees of the company. It is to be very much regretted that this fine hospital was destroyed by fire on January 17th, 1912.

There is much need of a hospital at Porcupine. The Dome Mines, Limited, have built and equipped a hospital for the care of their own employees. None of the other mines there have as yet provided any place where their sick or injured workmen may be cared for in the camp. It is necessary to send them to some hospital outside,—a journey which, in the case of badly injured or very sick persons, lessens their chance of recovery. A concentrated effort should be made at once for the erection of a mine hospital.

The Ventilation of Mines

The Mining Act of Ontario requires that "an adequate amount of ventilation shall be constantly produced, so that the shafts, adits, tunnels, winzes, raises, sumps, levels, stopes, cross-cuts, underground stables and working places of the mine and the travelling places to and from such working places shall be in a fit state for working and passing therein." But little attempt has been made in the mines of Ontario to adopt any form of artificial ventilation except compressed air, exhausted in the workings by the drills or blown between the shifts, for cleaning the workings of fumes resulting from blasting. It has been found necessary in coal mines to adopt complete systems of artificial ventilation owing to the presence in the mines of noxious gases. In recent years, however, owing to the extent to which some of the metalliferous mines have been worked, artificial ventilation has been adopted with most advantageous results.

The Transvaal Mining Regulations require the following standard of ventilation:—

I. In every metalliferous mine sufficient air shall be provided and such other arrangements made, that in any sample of air taken under normal working conditions from any part of the mine, not less than one hour after blasting:—

(a) The proportion of carbon dioxide shall not, as regards any mine within the Witwatersrand area, exceed 20 volumes per 10,000 of air=0.2 per cent.

(b) The proportion of carbon monoxide shall not exceed 1 volume per 10,000 of air =0.01 per cent.

No practically determinable amount of the oxides of nitrogen (NO and NO_2) shall be present.

At the East Rand mines ventilating fans were installed at the Angelo and Cason shafts, producing respectively 300,000 and 350,000 cu. ft. of air per minute. The effect on the air of the mine was marked. Before the installation of the fans an average analysis gave:—

CO_2	0.493 per cent.
CO	0.012 "

but after the installation of the fans:—

CO_2	0.127 per cent.
CO	0.005 "

The total cost of the equipment was about $125,000. Mr. Penlerick, the manager of the mines, states: "The cost is insignificant compared to the valuable results obtained, and under the circumstances some system of artificial ventilation should be adopted in practically every mine on the Rand."

A complete artificial ventilating system by means of fans has been in use at the Comstock mines, Nevada, for some years, and has proved most effective.

Another system that has proven beneficial is confining all the blasting operations to one shift.

There are many types of ventilating fans in use, the majority being fairly efficient. The installation and operation cost of any of these at the mines in Ontario, where the capacity required would not be great, would be comparatively small, and would be insignificant compared with the valuable results obtained.

General

A number of men every year receive injuries which can only be classified as serious. Through some constitutional weakness or neglect, other complications occasionally arise, resulting in death. There were three such cases in 1911, which have not been placed in the fatality list, though the injured men ultimately died.

Mr. V. Gravelle, employed as table helper at the Northern Customs Concentrator, had his back broken on April 27th, through falling a distance of about 12 feet to the floor. He was engaged in shifting a belt when in some way he lost his balance and fell backwards. Gravelle was cared for at the Cobalt Mines Hospital until Sept. 24th, when he was removed to his home. A few days after he contracted pleurisy and died as a result, on Oct. 14th. There is little doubt that the injury left him in a weakened condition, so that he was an easy victim to the disease.

Mr. C. Rinker was employed as foreman at the blast furnace of the Algoma Steel Company. He was burned about the neck and hands on Sept. 22nd, through the sudden dumping of a ladle of cinders on which he was working. On Oct. 15th he returned to work, these wounds being apparently quite healed, and worked three shifts. He then consulted a doctor, who told him that his heart was very much affected, and advised him to refrain from excitement or heavy work of any kind. He died on Oct. 29th. At the inquest the result of the post-mortem was given, and it was shown that heart disease was most marked, and that this was the primary cause of death, although it may have been hastened by the shock of the burns.

Martin Urenovizh, a laborer, employed at the blast furnace of the Algoma Steel Company, on May 5th, got a piece of hot metal in his eye. He was taken to the hospital, and, after examination and treatment, the doctor recommended that the eye be removed. Urenovizh refused to allow the operation to be performed, and as a result both eyes became badly infected, and his general health suffered. Finally he permitted the operation but the infection had become too widely spread, and he died on June 2nd. The attending physician states that there is no doubt that the man's life would have been saved had he permitted the operation to be performed at the proper time.

The following table summarizes the fatal accidents in or about the mines, giving the name of the person killed, nature of injury, cause of accident, etc.:

Table of Fatal Accidents

No.	Date.	Mine.	Owner.	Name and Occupation of Injured.
1	Feb. 13.	Beaver	Beaver Con. Mines Co.	George Rannick, powderman
2	Dec. 6.	Buffalo	Buffalo Mines, Ltd.	Wilfred Rheaume, drill helper
3	Dec. 23.	Silver Leaf	Crown Reserve	J. Graham, deckman
4	Dec. 26.	Calcite Lake	Calcite Lake Mg. Co.	Sigmund Terdk, mucker
5	Dec. 29.	do	do	Thos. Whitten, drill runner
6	Jan. 14.	Crean Hill	Canadian Copper Co.	Fred. Turcrack, trammer
7	Mar. 2.	Creighton	do	Roman Katyn, drill helper
8	June 28.	Crean Hill	do	Maetro Lazoveritch, trammer
9	Sept. 18	Creighton	do	George Wuori, drill helper
10	Oct. 11.	do	do	Ignot Vasilkoski, trammer
11	Nov. 30.	do	do	Nicholas Hluchaniuk, trammer
12	Dec. 8.	do	do	Patrick Sammon, powderman
13	Nov. 25.	Station Grounds.	Cobalt Station Grounds Mining Company	Michael Nace, laborer
14	Dec. 15.	Townsite	Cobalt Townsite Mg. Co	W. Mandley, drill runner
15	Oct. 27.	Dome	Dome Mines, Ltd.	Otto Nemine, drill helper
16	Dec. 9.	do	do	Marvin Sommers, laborer
17	Sept. 29.	Drummond	Drummond Mines, Ltd	John Kalaska, drill runner
18	June 26.	Foley O'Brien	Foley O'Brien Mg. Co.	Grovanni Gentile, drill helper
19	Jan. 26.	Helen	Lake Superior Power Co	John Maki, drill runner Oscar Mantynen, drill runner John Thompson, drill runner
20	May 22.	do	Lake Superior Power Co.	Louis Niemi, drill runner
21	Sept. 18.	do	Lake Superior Power Co.	Vertillio Spina, bucket tender
22	Mar. 27.	Hollinger	Hollinger Gold Mines, Ltd.	Fred. Dupuis, drill runner Joseph Knash, drill helper
23	June 16.	McKinleyDarragh	McKinley-Darragh-Savage Mines, Ltd.	Jas. Graves, drill runner
24	Mar. 8.	Millerett	Millerett Silver Mg. Co.	John S. Kennedy, shift boss
25	Jan. 29.	Garson	Mond Nickel Co.	Otto Heinanen, drill runner
26	May 10.	do	do	John Riley, drill runner
27	June 22.	Nipissing	Nipissing Mining Co	Victor Leina, drill runner
28	Nov. 6.	do	do	Peter Milensnic, drill runner
29	Jan. 19.	Norrington	R. W. Norrington	Albert Brunette, hammerman
30	Mar. 19.	Northern Pyrites	Northern Pyrites Mg. Co.	Geo. Cavazza, shift boss
31	May 23.	Nova Scotia	Nova Scotia Silver Cobalt Mining Co.	Aleck S'zniter, cage tender
32	Nov. 9.	Richardson	Kingston Feldspar and Mining Co.	Michael O'Connor, drill runner
33	Mar. 16.	Temiskaming	Temiskaming Mg. Co.	Albert Sullivan, drill runner
				Total

Table of Serious Non-Fatal

No.	Date.	Mine.	Owner.	Name and Occupation of Injured.
1	Jan. 20.	Atikokan	Atikokan Iron Co.	Wm. Bortis, drill runner
2	May 7.	Bailey	Bailey Cobalt Mines, Ltd	Henry Briscoe, drill runner
3	May 9.	Beaver	Beaver Con. Mines, Ltd	L. Salo, drill runner
4	Aug. 14.	do	do	H. Feener, carpenter
5	Sept. 18.	do	do	H. Russell, machinist
6	Dec. 5.	do	do	J. McGinnis, laborer

In or About Mines.

Below Ground	Above Ground	Nature of Injury.	Cause of Accident.
......	1	Back and right side injured.	Explosion in thawing house.
1	......	Skull fractured	Explosion resulting from drilling into bottom of missed hole.
1	......	Skull smashed and body very badly mangled	Fell down shaft.
1	......	Skull fractured	Fell from bucket.
1	......	Fracture of skull	Fell down shaft, due to staging giving way.
1	......	do	Fell down chute.
1	......	Whole body badly lacerated.	Struck bar into missed hole or some unexploded powder in muck.
1	......	Fracture of skull	Struck by rock, falling from back of stope.
1	......	do	Struck powder in cut-off hole while scaling.
1	......	do	Struck by falling rock or piece of steel.
1	......	do	Struck by falling steel.
......	1	Blown to pieces	Thawing house blew up.
1	......	Fracture of bone of skull	Fell from bucket down shaft.
1	......	Body greatly lacerated	Premature explosion due to fuse spitting into dynamite in untamped hole.
1	......	Fracture of skull	Struck by piece of falling rock in shaft.
......	1	Neck broken	Fall of shafting.
1	......	Head badly injured	Explosion of dynamite while loading hole.
1	......	Fracture of skull	Fell from bucket.
1	......	Body badly lacerated	Explosion of box of dynamite.
1	......	do	
1	......	Broken back	
1	......	Body lacerated	Fall of ore on which deceased was standing.
1	......	Instantly killed	Fell with car of muck down shaft.
1	......	Fracture of skull	Premature explosion in untamped hole.
1	......	Body lacerated	
1	......	Fracture of skull	Struck by hammer drill falling off staging.
1	......	Asphyxiation	Overcome by fumes from dynamite explosion.
1	......	Fracture of skull	Fell down stope into chute.
1	......	Chest crushed	Fall of piece of rock.
1	......	Fracture of skull	Drilled into hole containing explosive.
1	......	Chest badly crushed	Explosion while loading hole.
1	......	Killed instantly	Drilled into hole containing explosive.
1	......	Asphyxiation	Overcome by gas.
1	......	Fracture of base of skull	Fell down shaft.
1	......	Fracture of skull	Fell with drill down stope.
1	......	Asphyxiation	Unable to escape from winze after lighting round of holes.
33	3		

Accidents in or About Mines.

Below Ground	Above Ground	Nature of Injury.	Cause of Accident.
1	......	Shoulder bruised	Was sand blasting when apparently fuse spit into exposed dynamite.
1	......	Body slightly burned	Clothing caught fire from candle.
1	......	Right leg broken	Fell ten feet with staging.
......	1	Ankle sprained	Fell from roof of power house.
......	1	Right wrist broken	Fell from top of boiler.
......	1	Body bruised	Fell from scaffold while engaged on mill construction.

Table of Serious Non-Fatal

No.	Date.	Mine.	Owner.	Name and Occupation of Injured.
7	Dec. 18.	Beaver	Beaver Con. Mines, Ltd.	J. Olska, deckman
8	May 15.	Buffalo	Buffalo Mines, Ltd.	D. Desjardins, carpenter
9	Aug. 7.	do	do	H. Slack carpenter
10	Sept. 21.	do	do	W. Cooper, carpenter
11	Oct. 2.	do	do	H. Harrison, laborer
12	Nov. 1.	Buffalo Mill	do	Joseph Doyle, spare shift boss
13	Dec. 6.	Buffalo	do	Bert Reid, drill runner Isadore Marion, drill runner A. Hunton, drill helper
14	Aug. 17.	Badger	Badger Mines, Ltd.	E. O. Evans, laborer
15	Feb. 7.	Creighton	Canadian Copper Co	Ilia Puscas, trammer
16	Mar. 2.	do	do	Mike Baylick, drill runner
17	Apr. 27.	do	do	Yak Maki, drill runner
18	May 10.	do	do	Guiseppi Fera, trammer
19	May 5.	do	do	E. M. Medlen, time keeper
20	June 19.	do	do	Carmino Fisico, trammer
21	Aug. 25.	do	do	Walakin Manilan, block-hole driller.
22	Sept. 4.	do	do	Yalmar Virta, drill runner Emil Maka, drill helper Aisak Laari, drill helper
23	Oct. 26.	do	do	Adolphe Kinos, scaler
24	Feb. 7.	City of Cobalt	City of Cobalt Mg. Co.	A. Cain, drill runner
25	Mar. 7.	do	do	T. W. Bradley, drill runner
26	June 1.	Cobalt Lake	Cobalt Lake Mining Co	W. Biledo, carpenter
27	June 15.	Town Site	Cobalt Townsite Mg. Co	S. Donaldson, drill runner
28	Oct. 27.	Coniagas	Coniagas Mines, Ltd.	Henry Barkel, timberman
29	Nov. 9.	do	do	Thos. Hayward, drill helper
30	May 19.	Crown Reserve	Crown Reserve Mg. Co.	Edward Edwards, pump man
31	Oct. 14.	Dobie	Dobie Mines, Ltd.	Chas. Teare, trammer
32	Dec. 24.	do	do	E. J. Gaudet, drill helper
33	Oct. 25.	Dome	Dome Mines, Ltd.	J. Glasskowski, trammer
34	Sept. 15.	Gillies	John Gillies	Jas. Cowdy, laborer
35	Oct. 10.	Hollinger	Hollinger Gold Mines Ltd.	John Karpela, trammer
36	Sept. 12.	Hargraves	Hargraves Silver Mines, Ltd.	Thos. Troughton, drill runner Isaac Wilson, drill helper
37	Mar. 10.	Richardson	Kingston Feldspar and Mining Co.	John P. Cooper, trammer
38	May 4.	Kerr Lake	Kerr Lake Mg. Co.	G. Burgin, carpenter
39	June 17.	do	do	Herbert Day, powderman
40	Feb. 18.	La Rose	La Rose Mines, Ltd.	George Buhajczuk, drill runner
41	Apr. 27.	Lawson	do	M. Bajurink, nipper
42	Aug. 3.	do	do	John Szmyrk, trammer

Accidents in or About Mines—Continued.

Below Ground	Above Ground	Nature of Injury.	Cause of Accident.
	1	Fractured rib	Fell from trestle while dumping car.
	1	Concussion and shock	Fell from staging thirty feet.
	1	Index finger taken off at first joint	Came in contact with knives of buzz planer.
	1	Fingers of left hand cut	Came in contact with knives of buzz planer.
	1	Hip bruised	Fell off wagon.
	1	Arm badly lacerated	Clothing caught an exposed set screw on shaft.
1		Face injured	Explosion resulting from drilling into missed hole. (See Fatal Accident.)
1		do	
1		do	
	1	Fracture of clavicle	Fell from porch of boarding house.
1		Head cut	Struck on head by falling rock.
1		Cuts on body	Bar struck missed hole or some unexploded dynamite in muck.
1		Arm injured	Struck by piece of rock while scaling.
1		Lost sight of one eye	Struck by piece of rock while sledging.
1		Internal injuries	Struck by tram-car.
	1	Scalp wound	Struck by skip while passing under skip track on surface.
1		Lost sight of both eyes	Drilled into missed hole.
1		Face cut and eyes injured	Drilled into old hole.
1		Lost sight of both eyes	
1		Legs cut	
1		Head injured	Knocked off bench and down stope by falling rock.
1		Bruised.	Falling rock struck plank on which injured stood and precipitated him 10 feet.
1		Fractured rib and scalp wound	Fell about ten feet while timbering shaft.
	1	Concussion of brain and body bruised	Fell 43 feet while working on mill construction.
1		Slight concussion of brain	Fall of rock broke staging and precipitated injured 50 feet down stope.
1		Fracture of shoulder blade	Fell from ladder 6 feet.
1		Scalp wound and bruises to body	Pile of rock on which injured stood gave way and carried him down chute.
1		Bruised	Fell down winze 30 feet.
1		Scalp wound and cuts on head	Loaded bucket caught on timber and upset.
1		Leg bruised	Fell 15 feet in man-way of shaft.
1		Fracture of scapula and scalp wound	Struck by drill which fell down shaft.
	1	Arm broken	Struck by falling bucket.
1		Both arms had to be amputated	Overcome with gas and fell on candle.
1		Scalp wound	Struck by fall of rock while timbering raise.
1		Leg broken	
1		Fractured thigh	Struck by rock hurled by blast.
	1	Leg broken	Fall of jig.
1		Body bruised	Fell down winze 48 feet.
1		Right leg broken	While scaling, rock struck him on leg.
1		Hip and shoulder bruised	While taking steel up with him on cage piece caught on timber.
1		Left arm broken	Left arm caught in timber while riding up on cage.

Table of Serious Non-Fatal

No.	Date.	Mine.	Owner.	Name and Occupation of Injured.
43	Aug.28.	La Rose	La Rose Mines, Ltd.	George Robitaille, drill runner
44	Sept.11.	do	do	D. Tkacruz, trammer
45	Sept.13.	do	do	John Smith, trammer
46	Feb. 9.	Helen	Lake Superior Power Co.	Dan Vezmar, trammer
47	Feb. 15.	do	do	John De Diana, drill runner
48	Feb. 23.	do	do	L. Pegararo, drill runner
49	Mar.24.	do	do	G. Murma, trammer
50	Mar.29.	do	do	M. German, trammer
51	Apr. 7.	do	do	Valentine Trombine, trammer
52	Apr.19.	do	do	Harry Lipka, trammer
53	Apr.26.	do	do	John Matijczuk, trammer
54	Apr.19.	do	do	Mike De Sacco, drill runner
55	May 27.	do	do	G. Zanetti, trammer
56	May 31.	do	do	V. Monaco, chute tender
57	May 31.	do	do	G. DelFavero, laborer
58	June 1.	do	do	A. Alamaki, blacksmith
59	June 22.	do	do	J. Uba, trammer
60	June 24.	do	do	G. Svaluto, trammer
61	June 24.	do	do	A. Budzinski, trammer
62	July 26.	do	do	Geo. Del Ferro, trammer
63	Aug.21.	do	do	T. Wolosianka, crusherman
64	Oct. 7.	do	do	Victor Muki, drill runner
65	Oct. 10.	do	do	Thomas Dudgeon, machinist
66	Oct. 30.	do	do	J. Marastini, trammer
67	Nov. 13.	do	do	L. Svanson, chute tender
68	Dec. 14.	do	do	A. Chatinaca, skip tender
69	June 22.	Magpie	do	Victor Salo, hand driller Anti Hankela, hand driller
70	Apr. 4.	Burgess	Manufacturers' Corundum Co., Ltd.	Neil McAlpine, trammer
71	Sept.22.	T. R. 57	Reginald Merriman	W. Wilkinson, laborer
72	Sept.20.	McIntyre	McIntyre Porcupine Mines, Ltd.	Robt. Richardson, drill helper
73	May 29.	Nipissing	Nipissing Mg. Co., Ltd.	J. Robin, drill runner
74	Jan. 19.	Norrington	R. W. Norrington	Fred. Carroll, hand driller
75	Apr 27.	Mill	Northern Customs Concentrators, Ltd.	V. Gravelle, table helper
76	Nov. 28.	Quarry	Port Credit Brick Co.	H. Proinor, signal man
77	Oct. 6.	Swastika	Swastika Mining Co.	John England, drill runner
78	Jan. 25.	Temiskaming	Temiskaming Mg. Co.	William Allan, drill runner
79	Dec. 23.	do	do	E. Dunnigan, timberman
80	July 24.	Henderson	S. Wellington	John Reeves, trammer
				Total

Accidents in or About Mines—*Continued.*

Below Ground	Above Ground	Nature of Injury.	Cause of Accident.
1		Shoulder and hip bruised	While scaling from staging, rock fell breaking staging causing him to fall.
1		Big toe broken	Rock rolled from top of muck pile on it.
1		Arm bruised	Jammed arm between car and rock.
1		Large toe broken	Bucket fell on toe.
1		Bones in foot broken	Rock fell on foot.
1		Sprained ankle	Struck by piece of ore, falling from chute.
1		Right hand bruised	Hand caught between car and truck.
1		Left hand bruised	do
1		Large toe broken	Rock fell from chute on foot.
1		Sprained ankle	Cage dropped 25 feet due to friction slipping.
1		Finger broken	Caught finger between car and truck.
1		Leg broken	Cage dropped 25 feet due to friction slipping.
1		Finger broken	Piece of ore fell from chute on hand.
	1	Tear in scrotum	Fell from ore car.
	1	Ankle injured	Struck on ankle by piece of iron.
	1	Face burned	Face burned in blacksmith shop.
1		Foot injured	Piece of ore fell from chute on foot.
1		do	Piece of ore fell from chute on foot.
1		Nail torn off thumb	Piece of ore fell from chute on hand.
1		Fingers cut	Hand jammed between car and rock.
	1	Eye injured, sight impaired.	While sledging ore, piece flew, striking him in eye.
1		Eye injured	Got piece of ore in eye.
	1	do	Got piece of emery from wheel in eye.
1		Finger crushed	Piece of ore fell on hand.
	1	Finger broken	Hand caught while coupling car.
1		Finger crushed	Caught finger between car and skip.
	1	Right hand blown off	While loading hole explosion occurred. Were working on sewer trench.
	1	Eye and nose injured	
	1	Three ribs broken, also collar bone	Went under frozen pile of broken rock which fell on him.
	1	Two ribs broken	Side of trench caved in on him.
1		Head badly lacerated	Became gassed, and fell from ladder.
1		Wounds and bruises on head and body	Fell twenty feet down raise.
1		Leg broken	Drilled into hole containing explosives.
	1	Back broken (died on Oct. 14th of pleurisy)	Trying to shift belt guard, when he lost his balance and fell 14 feet.
	1	Injury to spine	Fell a distance of twenty feet from a rock bin.
1		Scalp wounds	Fell from ladder down man-way.
1		Fracture of the skull	Fell down a stope a distance of about 80 feet.
1		Leg broken	Fell about 12 feet, due to breaking of sprag holding platform on which he was working.
1		Arm broken	While scaling, rock falling hit bar, jamming Reeves against wall.
60	26		

Accidents at Metallurgical Works

Inspection of the metallurgical works of Ontario forms part of the duty of the Inspector of Mines. These works include blast furnaces, copper-nickel smelters and converter plants, and silver smelters. At such works during 1911 there were nine fatalities.

Blast Furnaces

At blast furnaces two men were killed in 1911. One of these men was run over by a yard engine. A number of non-fatal accidents also occurred from this cause. It is essential in blast furnace yards, where there is so much noise at all times from the furnace, to have all engines, trolley cars, etc., provided with an efficient alarm bell or gong, which can be rung continuously when moving where workmen are employed. Another man was killed by being struck on the head with a brick falling from a platform inside the furnace when bricklayers were at work re-lining it. Care should be taken in such cases to see that men are never put to work immediately below other workmen unless proper protection is afforded them. A number of serious accidents occur annually at the blast furnaces due to burns received. These burns are either caused by hot cinders, or by explosion of the molten iron due to its coming in contact with water. Proper care should be taken to see that the workmen working in proximity to this hot material are properly clothed to afford protection. More use should be made of shields, asbestos mitts, etc.

Copper-Nickel Smelters and Converter Plants

Six men lost their lives while employed at copper-nickel smelters and converter plants. One of the men was crushed between cars in the converter building. The same care should be taken in having the engines equipped with alarm bell or gong as for engines around blast furnaces. Another man while working on the top of the converter patching up a hole with fire-clay, was struck by a piece of matte and slag, falling a distance of about two feet, from the converter hood. The man was struck on the back of the head, and the blow caused a fracture of the base of the skull, which resulted in his death.

Another man received fatal injuries by the fall of the converter hood, due to the breaking of the bar on which the hood was hinged. The pieces of the broken bar were subjected to a microscopic examination, and the bar was found to be composed of what is known as "bushelled" wrought iron. This class of iron bar is not suited to such a use on account of its lack of uniformity of texture.

A third workman while engaged in repairing, fell through the roof of the converter building, and was killed. The tiles with which the roof was covered had deteriorated, owing to the action of the gases. They were being replaced by new ones and the man was engaged at this work. He inadvertently stepped off the plank on which he was standing, which broke, allowing him to fall to the floor.

A fourth man was killed by an explosion in the settler, which must have been caused by the metal coming in contact with a leakage from one of the coolers. The man was burned to death by the molten matte.

An engineer in a smelter power-house was electrocuted through coming in contact with a high pressure wire. Sufficient care is not always taken in transformer rooms to have the high voltage wires removed from easy access. No matter how experienced a workman may be, he is apt at times to forget the necessity of constant care in the neighborhood of electric wires carrying high voltage. Such wires should, therefore, be so installed that a workman could not come in contact with them without some effort of his own. This would eliminate nearly all the accidental shocks.

Silver Smelters

Silver smelters furnished one fatality during the year. This occurred while the employee was engaged on construction work outside of the building. While on a scaffold six feet above the ground the scaffold fell, and the man had his back broken and died a few days later.

There were employed at the metallurgical works during 1911, approximately 3,718 men. At these works nine men were killed, which is equivalent to 2.42 per 1,000 men employed.

The following table shows the number and nationality of the men killed at the various classes of work at the metallurgical plants:

	English Speaking	Polander	Finlander	Italian	Total
Engineer	1	....	....	....	1
Tuyere puncher	....	1	....	....	1
Tapper	1	....	....	....	1
Converter puncher	....	....	....	1	1
Carpenter's helper	....	....	1	....	1
Converter puncher's helper	....	1	....	....	1
Laborer	....	....	....	2	2
Carpenter	1	....	....	....	1
Totals	3	2	1	3	9

Cause and Place of Fatalities at Metallurgical Works

		1911	1910.
BLAST FURNACES:			
Run over by yard engine	1		
Struck by falling brick while re-lining furnace	1		
	—	2	3
COPPER-NICKEL SMELTERS AND CONVERTER PLANTS:			
Explosion in settler	1		
Crushed between cars	1		
Struck by piece of slag falling from hood	1		
Falling through roof while engaged in repair work	1		
Falling of converter hood through breaking of bar	1		
Electrocuted in power-house	1		
	—	6	4
SILVER SMELTERS:			
Falling from scaffold	1		
	—	1	3
		—	—
Total		9	10

Cause and Place of Non-Fatal Accidents at Metallurgical Works

BLAST FURNACES:		
Falling from elevated places	2	
Falling objects	1	
Run down by cars	5	
Burned	8	
Part of body coming forcibly in contact with object	2	
	—	18
COPPER-NICKEL SMELTERS AND CONVERTER PLANTS;		
Falling	1	
Falling objects	1	
Struck by skip	1	
	—	3
SILVER SMELTERS:		
Falling from elevated places	2	
Caught by machinery	2	
	—	4
		—
Total		25

A table follows giving particulars of the fatalities at the metallurgical works; also one with regard to the serious non-fatal accidents.

Table of Fatal Accidents at

No.	Date.	Works.	Owner.	Name and Occupation of Injured.
1	July 15.	Blast furnace	Algoma Steel Co.	Geraldi Vinzinzi, laborer
2	Jan. 16.	Converter plant	Canadian Copper Co.	P. Pologseyk, tuyere puncher
3	Mar. 27.	Smelter	do	Arthur Jennings, tapper
4	Apr. 5.	Converter plant	do	Valpini Attillio, converter puncher.
5	Aug. 15.	do	do	John Mieska, carpenter's helper
6	Oct. 28.	do	do	Ignotz Chiptomi, converter puncher's helper
7	Apr. 6.	Smelter	Coniagas Reduction Co.	Wm. Allen, carpenter
8	Aug. 4.	Power house	Mond Nickel Co.	Chas. Longfellow, engineer
9	Oct. 10.	Blast furnace	Steel Co. of Canada	David FeDuzzi, laborer
				Total

Table of Serious Non-Fatal Accidents

No.	Date.	Works.	Owner.	Name and Occupation of Injured.
1	May 1.	Blast furnace	Algoma Steel Co.	Raffael Gullo, laborer
2	May 5.	do	do	Martin Urenovizh, laborer
3	Aug. 28.	do	do	Fabio Finani, laborer
4	Sept. 7.	do	do	John Murray, stove tender
5	Sept. 8.	do	do	Peter Brown, labor foreman
6	Sept. 16.	do	do	Campanelli Dellino, laborer
7	Sept. 17.	do	do	G. Guglielimine, laborer Pietro Artusi, laborer
8	Sept. 21.	do	do	Roy Goatbe, brakeman
9	Sept. 22.	do	do	Chas. B. Rinker, night foreman
10	Oct. 24.	do	do	Valenti Micheli, yard foreman
11	Oct. 30.	do	do	John Clarke, hoistman
12	Nov. 5.	do	do	John Sirkoe, keeper
13	Nov. 21.	do	do	Hector Gagnier, oiler
14	Nov. 23.	do	do	John Cutigras, laborer
15	Dec. 16.	do	do	Arthur Strand, blower
16	Mar. 25.	Converter plant	Canadian Copper Co.	Baoli Bacco, laborer
17	June 19.	do	do	Fachimi Getulia, liner
18	Feb. 6.	Smelter	Coniagas Reduct'n W'ks	Chas. Welham, laborer
19	Nov. 8.	do	do	Walter Rapsey, carpenter
20	Dec. 13.	do	do	Herbert Putnam, carpenter
21	Dec. 19.	do	do	Henry Carter, ass't foreman
22	June 26.	do	Mond Nickel Co.	John Smith, laborer
23	Jan. 22.	Blast furnace	The Steel Co. of Canada	Tomaso Silenze, laborer
24	Nov. 6.	do	do	Benj. Carter, pitman
				Total

Metallurgical Works.

No. Killed.	Nature of Injury.	Cause of Accident.
1	Body seriously cut up	Run over by engine in blast furnace yard.
1	Thigh and abdomen crushed.	Caught between drawbars of two cars.
1	Burned to death	Explosion of settler, due to leakage in cooler.
1	Fracture of base of skull ..	Struck by piece of slag falling from hood.
1	Injury to spinal column .. .	While repairing roof, stepped on defective tile and fell to floor below.
1	Pelvic bone fractured, which punctured bladder	Bar supporting converter hood broke, precipitating injured to floor.
1	Fracture of spinal column.	Fall of scaffold.
1	Electrocuted	Came in contact with wire carrying 15,000 volts.
1	Deep gash at base of skull...	Struck by falling brick while relining furnace.
9		

at Metallurgical Works.

No. Injured	Nature of Injury.	Cause of Accident.
1	Foot cut off below instep....	Run over by train.
1	Right eye burned	Struck by hot cinder in right eye; refused proper treatment, and died 2nd June, from septic embolus.
1	Leg injured	Bucket dropped on leg.
1	Right foot scalded	Escape of hot water from furnace pipe.
1	Knee injured	Struck knee on small pipe.
1	Legs burned	Cinder ladle burst.
1	Neck burned	Furnace slipped, throwing out hot coke.
1	Neck burned	
1	Left leg injured	Thrown off while standing on foot-board of engine.
1	Hand and neck burned	Ladle of cinders dumped unexpectedly.
		Rinker returned to work Oct. 15, and worked three days. He went home and consulted a doctor, who told him he had heart disease. He died from arrested circulation, on Oct. 29th, 1911.
1	Heel crushed	Struck by cinder ladle, kicked in on cinder track by locomotive.
1	Ankle sprained and head cut.	Overcome by escaping gas while replacing hook on charging can, and fell to top of furnace.
1	Left leg and both hands burned	Struck by molten iron ejected from furnace while drilling clay from iron hole.
1	Toes on right foot crushed ..	Scale car ran over foot.
1	Leg cut	Man struck by passing car.
1	Face burned and pitted	While changing tuyere, iron ran out, struck water and exploded.
1	Injured internally	Prying on bar, when it suddenly gave way.
1	Leg injured	Leg crushed by drop ball on converter.
1	Right knee injured	Fell from ladder 15 feet.
1	Fracture of tip of right elbow.	Fell from ladder.
1	Index finger of left hand cut off	Hand came in contact with jointer knives.
1	Left leg and two ribs broken, other bruises	While oiling main shaft, clothing became wrapped around it.
1	Scalp wound, bruised back..	Struck by skip.
1	Knee and chin cut	Fell 15 feet.
1	Several ribs broken	Fell over iron box while running away to avoid being burned.
25		

Accidents at Quarries

Under this heading are classified the accidents that occur in all kinds of stone quarries and in excavations at brick yards.

Four fatalities occurred at stone quarries during 1911, all of which were on the surface and not in the quarry. Two men were killed while engaged in shovelling fine rock from a car, owing to another car striking it. Both cars were on a siding which had a heavy grade. A loaded car was being let down from the bins, but the brakes did not work properly and the man lost control of it. It struck the car in which the two men were working, throwing them on the track where they were crushed beneath the wheels.

Another workman was crushed between two locomotives. One locomotive was off the track and the other one was being used to push it back on the track. A tie was placed between the bumpers of the two engines to accomplish this. The tie slipped and the man was caught and crushed to death.

An engineer in the power-house at one of the quarries was killed through being struck with a piece of rock projected by a blast in the quarry. There is not sufficient care taken at quarries to have proper shelters for the men wherein they may take refuge while a blast is being discharged.

There is also much negligence shown around quarries in the handling of explosives. The management in a number of cases seems to be either ignorant or careless in the matter of providing proper magazines and thawing houses. It is just as essential to have a proper thawing house, where only a few sticks of explosive are being thawed, as if it were an equal number of cases. There is also negligence shown in the reporting of accidents. All accidents that are likely to incapacitate a workman for seven days or over must be reported within 24 hours after the time of occurrence.

Table of Fatal

No.	Date.	Quarry.	Owner.	Name and Occupation of Injured.
1	Mar. 28	Doolittle & Wilcox	Doolittle & Wilcox, Ltd.	Medio Toro, laborer .... Louis Pace, laborer ....
2	Sept. 22.	do	do	Ernest Finlay, crusher man ......
3	April 19	Hagersville......	Hagersville Contracting Company	George Arthur Howard, engineer..
				Total..........................

Cause and Place of Fatalities at Quarries

		1911.	1910.
In quarry		0	1
On surface:—			
Run over by car on siding	2		
Crushed between two locomotives	1		
Struck by flying rock	1		
	—	4	0
		—	—
Total		4	1

The following table shows the occupation and nationality of men killed at quarries:

Occupation.	Canadian.	Italian.	Total.
Labourers	.....	2	2
Engineer	1	.....	1
Crusherman	1	.....	1
Total	2	2	4

There were employed at the quarries during 1911, approximately 1,402 men. At these quarries four men were killed, which is equivalent to 2.85 per 1,000 men employed.

The following table sets out the particulars of fatal accidents in the quarries :

Accidents at Quarries

In Quarry	On Surface	Nature of Injury.	Cause of Accident.
......	1	Body crushed	Unloading a car on siding, when it was struck by another coming down grade.
......	1	Legs crushed	
.....	1	Body crushed	While assisting to replace locomotive on track, crushed between it and another locomotive.
......	1	Fracture of skull	Struck by piece of rock hurled by blast.
......	4		

Details of Fatalities

In the following pages the fatal accidents of the year are described in some detail, in the hope that the information may be useful in impressing upon all concerned the need for constant vigilance and steady forethought on the part alike of employers and employed. Particulars of mining fatalities are given first, followed by those in metallurgical works, and afterwards by those in quarries.

Beaver Silver Mine

At the Beaver mine on February 13th, at 3.30 a.m., George Rannick, an Austrian, was killed by the blowing up of the thawing house. Rannick was powderman on the night shift and had gone to the thawing house to make up loads for a machine-runner, named Salo. Salo went to the thawing house when his powder was ready, told Rannick to make up eight more loads, and then returned to the shaft house. About a minute later the explosion occurred. Rannick's body was found 60 or 70 feet from the side of the thawing house, and from his position, and the nature of the injuries, which were all on the back and right side, it would seem he was not in the house when the explosion occurred. Apparently Rannick had some warning of danger and was trying to escape. Salo, the last man in the thawing house, stated that Rennick had a lighted candle in the thawing house, placed on a ledge and within about five inches of an open box of detonators. There is, therefore, little doubt as to the cause of the accident. The thawing house was covered with corrugated iron and heated by steam pipes. At the inquest held on February, 17th, Salo, the important witness, was not present. His evidence was, however, later obtained by the Inspector of Mines, which brought out the fact that Rannick had a lighted candle in the thawing house, just a few minutes prior to the explosion.

Buffalo Silver Mine

At the Buffalo mine on December 6th Wilfred Rheaume, a Frenchman, aged 25 years and single, was instantly killed.

The deceased was employed as drill helper on the third level of the mine in the cross-cut towards No. 6 shaft, the cross-cut being about nine feet wide and the usual height. Two machines were at work in it at the time of the accident. Bert Reid was runner on the drill on which the deceased was helping. Isadore Marion was runner, and A. Hunton helper, on the drill on the opposite side of the drift. On Tuesday night three of these men employed in the cross-cut completed the drilling of a round and blasted it. They first loaded six holes and blasted them, getting four reports. On going back and examining the face they found all the holes had gone. They then loaded the remaining thirteen holes and blasted them, getting eleven reports. The explosive used was 40 per cent. dynamite. On returning to the heading they found that two holes on the upper lefthand corner of the heading had been cut off, leaving dynamite in both of them. They re-charged these holes and loaded another one that had not broken, and blasted the three, getting three reports. The machine-men apparently concluded that these two holes in which they found the dynamite were the two from which they did not get reports. The runner, Isadore Marion, however, met the runner of the same machine on the opposite shift and gave him the particulars. No report was made to the shift bosses or to the mine captain, and these officials were ignorant of what had been the result of the blasting in this heading that night. On the day shift the mucking resulting from the blasts had been taken out and several holes drilled in the upper part of the face. On Wednesday night the four men mentioned above went to work, Bert Reid running the machine on the righthand side of the drift, as on the night before, and Isadore Marion the other machine. They worked up to about 5 a.m., when Reid was engaged in drilling the lifter on the righthand side, and Marion the centre lifter. Reid found that the bottom of the cross-cut on his side had narrowed a little, and therefore he had to start the side lifter a little back from the face, with the hole looking towards the wall. He had drilled this hole to depth of thirty inches to three feet when an explosion occurred, killing his helper, Wilfred Rheaume, instantly, and slightly injuring himself and the two other men. Rheaume sustained a fracture of the vault of the skull.

In company with Mr. Sutherland, Assistant Inspector of Mines, and the mine captain, William McAllister, the writer made an inspection on the morning of December 7th, and found that the explosion had been caused through Reid drilling into the bottom of a missed hole. This hole had been drilled and loaded by Reid on the night before, but for some unknown reason must have missed fire. The hole was drilled parallel to the side of the cross-cut and the collar of it was about 10 inches from where Reid started the hole that caused the explosion.

An inquest was held at Cobalt on December 7th by Dr. Hair, and the coroner's jury returned a verdict in which they attributed the accident to neglect on the part of the machine runners.

Calcite Lake Silver Mine

At the Calcite Lake mine on December 26th, Sigmond Terdk, employed as a trammer was killed by falling from the bucket.

The deceased, a Hungarian, 21 years of age, single, arrived at the Calcite Lake mine from Cobalt at noon on December 25th, and hired as a trammer. He went to work in the shaft on the night of the 25th at 12 o'clock, and again on the night of the 26th at 7 o'clock. In the shaft, which is 275 feet deep, a station was being cut at the 270-foot level. No other underground work was in progress.

Shortly after 9 o'clock on the night of the 26th, deceased went on deck for some tobacco and took the water pail with him. A bucket of rock was sent up, and on the return trip the deceased started down in the bucket with the pail of water. He put one foot inside the bucket and the other hung outside. On this trip the crosshead stuck on the guides about 8 feet below the collar of the shaft, and when the bucket had been lowered about 130 feet the crosshead became loosened and followed the bucket. The deceased heard the crosshead coming, and either tried to catch the timber or bent away from the cable to such an extent that he tumbled backwards out of the bucket. The man was instantly killed. This crosshead was not equipped with a safety appliance, and in cold weather was known to stick about 8 feet below the collar of the shaft. The deck-man was supposed to watch and see that the crosshead passed this place safely. On this night the deck-man was a new hand, having been hired at the same time as deceased. The latter had been warned by the other trammers to watch the crosshead, but had not been warned by the manager. No captain or shift boss is employed at this property.

The manager stated that the crosshead had been in use since March, and that he did not know it was not in accordance with the Mining Act. He had made several attempts to rig up a safety appliance without success.

The company were prosecuted by the Inspector of Mines for a violation of Sec. 164, rule 24a of the Mining Act of Ontario, and fined $100 and costs.

At this mine on December 29th, Thomas Whitten, machine runner, was killed by falling from a staging in the shaft.

The deceased, a Scotchman 26 years of age and single, had been employed as machine runner at the Calcite Lake mine for about a month. On the afternoon of December 29th Whitten and another machine man, by the name of Stojko, with their helpers, were timbering the shaft. They had put in a station in the man-way and one ladder, and were preparing to place a set in the shaft. To do this a staging was put in about seven feet below the last set; it was suspended by ropes from three corners and a chain on the fourth corner from a hanger fastened to the hanging rods. This hanger was made of ¾-inch iron, bent at right angles with a hook at one end, to be attached to the hanging rods on the lowest set of timber, and a ring on the other end of it. The ring was not completely closed, the opening being about 1⅛ inches. A piece of 1¼-inch rope was used for holding the staging, and was supposed to be threaded through the ring on the hanger and tied with two half hitches, the loose end of the rope being fastened to the main rope by means of battery wire. The men put in the staging and worked about 20 minutes, when one corner gave way, and Whitten dropped to the bottom, a distance of about 25 feet, sustaining a fracture of the jaw and a compound fracture of the skull. He died about ten hours later. It would appear that when the hanger was attached to the hanging rods it was turned to one side; when righted, the 1¼-inch rope, instead of lying on the lower side of the pass ring, was looped through the upper, or open side of it. This opening was just about 1⅛ inches, which explains why the staging held for about 20 minutes with Whitton working on it.

The coroner's jury brought in a verdict of accidental death.

Canadian Copper Company

At the Crean Hill mine on January 14th Fred Turcrack, Polander, employed as trammer, was killed through falling into a mill hole in the No. 3 stope of the fourth level.

The system of mining followed at this mine is to fill the stopes with waste rock, carrying up mill holes at regular intervals for handling the ore. In this stope the filling was about fifty feet above the level, and, at the time of the accident, the mill hole was emptied to within about 10 feet of the level.

The gang of trammers had just returned from dinner and were working within 20 to 25 feet of the mill hole. A large acetylene light was used for lighting the stope and was within a short distance of the mill hole. Turcrack apparently fell into the mill hole while returning to work after dinner, as he was seen in the level about 1 o'clock, and his body was found in the chute about 1.15 p.m. The mill hole was circular, 3½ feet in diameter, and the ore was trammed to it from the ore pile on a track. The tops of the mill holes are supposed to be kept covered, excepting when the trammers are at work dumping into them. It was uncertain just how this man happened to fall into the mill hole, as there was no witness to his fall.

The coroner's jury brought in a verdict of accidental death.

At the Creighton mine on March 2nd Roman Katyn, drill helper, was killed through an explosion of dynamite in the broken ore while working at the edge of the open pit.

On the night shift of March 1st the deceased, with drill runner Mike Bayluk, drilled two 10-foot holes and loaded them with six sticks of 40 per cent. dynamite each, blasting at 6 a.m., March 2nd. After blasting they went back and scaled down until 7 a.m. No work was done at this place during the day, and at 7 p.m. Katyn and Bayluk went back to work where they had left off in the morning. About 7.45 p.m., while Bayluk was shovelling and Katyn barring out a piece of rock, an explosion occurred that killed the latter and injured the former. The explosion was apparently caused by Katyn's bar setting off some unexploded powder in the broken material or striking a cut-off hole. Bayluk was incapacitated for work for 29 days.

The coroner's jury brought in a verdict that Roman Katyn came to his death while using a bar in a muck pile, from an explosion of dynamite.

At the Crean Hill mine on June 28th, Maetro Lazoveritch, a Polander, employed as trammer, was killed through being struck on the head by a falling rock.

The deceased was 19 years of age and was employed as trammer on the dry wall of No. 3 stope, near No. 9 chute, on the fourth level. The roof of this chute is about 30 feet above the dry wall. The scaling reports show that the stope had been examined on the day of the accident by three men employed continuously on day shift scaling on this level. The stope had been examined and scaled practically every day that work had been carried on in it for two or three weeks prior to the accident. The block holer, Mike Murmock, was standing about four feet from the deceased when he was struck by the rock, and states that the piece of rock fell from the roof and was about two and a half pounds in weight. Two other men were near at the time of the accident, but did not see the piece of rock strike the deceased.

Drs. Morrison and McAuley gave evidence that the injured man was brought to the hospital about 9 p.m., June 28th, and they at once performed an operation to raise the broken part of the skull. The man, however, did not recover from the effects. They stated that there was a fracture of the skull about 1½ inches in circumference on the back of his head, and that death was due to concussion caused by the blow.

At the inquest held in Copper Cliff on July 6th the scalers, shift boss and superintendent were examined regarding the scaling done on this stope. Their evidence corroborated the statements given in their scaling reports. The coroner's jury brought in a verdict of accidental death.

At the Creighton mine on September 18th, George Wuorri, drill helper, was killed.

The deceased was a Finlander, 25 years of age, and was employed as drill helper on the fourth level back-stope. He, in company with his partner, Henry Ramy, fired a round of two holes at 11 o'clock on Saturday night. On Monday morning both men proceeded to the place where these holes had been fired and began scaling. They worked about ten minutes, when an explosion occurred, which fatally injured Wuorri and slightly injured his partner. The evidence seemed to show that Wuorri and his partner started to scale as soon as they went into the stope. None of the shift bosses had got round to this part of the stope to examine it before the explosion, consequently it is impossible to get an intelligent description of the back, as it was before the explosion occurred. The evidence, however, showed that Wuorri was picking and prying with his scaling bar immediately before the explosion. He must therefore have struck a hole in which there was some explosive. Whether this hole was a cut-off hole, or whether some powder remained in the bottom of a hole that had failed to explode, it is impossible to say. The nearest machine hole to it was five to seven feet away. It therefore seemed improbable that it was a cut-off hole. It would be almost impossible for anyone to examine the back of this stope, which was only about six feet above the broken material, and not find this old bottom before the explosion. It would accordingly appear that neither the machine man nor his helper examined the back of the stope thoroughly before commencing to scale.

Dr. McAuley gave evidence at the inquest held at Copper Cliff by Coroner Farnham on September 23rd, that George Wuorri was brought to the hospital about 9.30 a.m. September 18th, in an unconscious condition. He found his left eye was destroyed and his skull fractured above and in front of the left ear, the brain exuding. He died about 6 o'clock the same night.

On October 11th, Ignotte Vasilkoski, a Polander, single, about thirty years of age, employed as a trammer, at the Creighton mine, received injuries, which resulted in his death, on October 17th.

The deceased, at the time of the accident, was, with four others, tramming in the open pit, on the 300-foot level, on the hanging-wall side of the pit. About 35 feet above these trammers, two machines, operated by Polanders, were carrying down a bench, which was about eight feet wide, and overhanging. The car, into which the trammers were shovelling, was slightly under the bench, but the trammers themselves, working on the outside of the car, would not be so protected. The deceased was struck by some falling object at about 4 a.m., although none of the witnesses would state that they had actually seen him struck, or what struck him. The pit was lighted by a large acetylene lamp. A drill starter was found beside the man, after he had been struck. This steel had blood on the bit end, and had not been noticed by any of the trammers before the accident. The starter was sharp, and the machine men gave evidence that they had taken in their own steel, and had not passed the place where the men were tramming, consequently the steel could not have been dropped while these men were carrying in their tools.

At the inquest, the machine men and the trammers all tried to make it appear that a rock had struck the deceased. The shift boss, however, gave it as his opinion that the man was struck by a piece of steel. The coroner's jury brought in a verdict that

Ignotte Vasilkoski met his death by being struck by a piece of rock falling from parts unknown.

Nicholas Hluchaniuk, a Polander, aged 32, was injured at the Creighton mine, 30th November, dying as a result of the accident on December 2nd.

The deceased was employed as a trammer on the third level of the Creighton mine in the open cut. He was working with a gang of about fourteen men, tramming into two cars from the broken material, near the north wall of the open pit. Two machine men, Henry Heinanen and Otto Malinen, were working on a bench, about 80 feet above the level of the open cut and about 50 feet from the surface. This bench had apparently an average width of six feet. At the time the accident occurred, Malinen was on the bench, and Heinanen was at the surface lowering six drills from the surface to this bench. When the drills were lowered part way, Malinen alleges that he heard a steel falling past him down the wall of the stope, and shouted to the men working below to watch out. The men below heard the shout and ran for the shaft, but Nicholas Hluchaniuk was struck when a few steps away from the rock pile. The blow was on the head, the man sustaining a compound fracture of the base of the skull, from which injury he died on December 2nd, about 9 p.m.

An inquest was held at Copper Cliff, on December 8th, by Coroner Farnham, and a verdict of accidental death was returned.

On examination of the place where the accident occurred, it was found that the deceased had been struck by an 8-foot drill, which was dull, showing that it was not one of the drills being lowered by the machine men, mentioned above. It was impossible at the inquest to ascertain just where this steel came from, although it was proved conclusively that it fell from somewhere on the face of the stope. In all probability, it came from the bench on which was the machine helper, Otto Malinen, who, no doubt, accidentally caused the steel to fall. The men below, however, were not warned of the fact that they were about to lower steel from the surface to the bench, which the several foremen alleged was the usual practice, but which, apparently, was not carried out with any degree of regularity. It would not appear, however, that the machine men on the stope were to blame, to any great extent, for the accident.

At the Creighton mine, at 4.30 a.m., on December 8th, Patrick Sammon, powder man, was killed by an explosion of powder in the thawing house.

The deceased, a Canadian, 25 years of age, and single, had been employed at the Creighton mine for seven months.

The thawing house was a frame building, about 16 by 22 feet, and was heated by hot water circulating through pipes. The water was heated by a water-jacketed stove, situated in a building about 40 feet distant from the thawing house. The pipes were placed around the walls of the thawing house, and the racks in which the dynamite was placed were set out from the pipes sufficiently far to ensure no drip or leakage from the dynamite, coming in contact with them. The thawing house was divided into three rooms, the large one at the back being used exclusively for the thawing of explosives. The outside door opened into a room where dynamite in boxes could be placed before it was put in the racks. Opening from this room was a door leading into a small room in which the exploders were prepared for blasting.

The last time the writer inspected this thawing house was on September 23rd, 1911. At that time it was found that the building was kept clean and in good condition, with the exception that there was an over supply of explosives in it, and that an iron wedge was being used to open boxes. Both these facts were mentioned to Mr. John Lawson, general superintendent of the Company, who then instructed Mr. Wm. Hambly, superintendent of the mine, to have both the objections removed.

At the inquest, held at the Creighton mine, on December 9th, John Sippola, the powderman on the day shift, gave evidence that he left in the thawing house, when he went off shift at 7 o'clock, on the night of December 7th, approximately 3,700 sticks of dynamite. This would be about 42 cases, or 2,100 pounds. According to the evidence of Wm. Hambly, the superintendent, the requirements for twenty-four hours at the Creighton mine are from 2,000 to 3,000 sticks. This would mean that there were on hand about 700 sticks more than the maximum requirements for twenty-four hours. The daily returns show that on December 5th, there were actually used 2,147 sticks during the twenty- four hours. The explosive in the thawing house at the time of the accident was 40 per cent. dynamite, manufactured by Curtis and Harvey, and, in addition, 159 sticks of gelignite. At about 4.20 a.m., Frank Durand, nipper, took an order to the thawing house for dynamite for the shaft men. Sammon took the order at the door of the thawing house, and told Durand to come back at a quarter to five and help him carry the powder to the shaft. Durand then saw him take a bag and start into the thawing house, presumably to fill the order. When Durand got to the corner of the dry, about 300 feet distant from the thawing house, and about two minutes after speaking to Sammon, the explosion occurred. There had been two or three men at the thawing house that night, and all stated that everything seemed as usual there. They saw no naked lights, excepting the lantern used for lighting the thawing house, and no one had ever seen Sammon smoking while on duty.

The writer arrived at the mine about five hours after the explosion, and, therefore, had a good opportunity to observe the results of it. It was found that Sammon had been practically blown to pieces. All that was found of him was about 15 pounds of flesh and pieces of bones. The doctor was able to identify a piece of the skin found as human skin, and a small section of the scalp was found, with hair on it the same color as Sammon's. A sweater and trousers were also found similar to those worn by Sammon on the night of the accident. The thawing house was also literally blown to pieces, there being no pieces large enough to do any damage thrown more than 100 feet from the building. Considerable injury was done to property at the mine, and also to to the houses of the town, through the breaking of windows by the concussion. No one was injured in the least by the explosion, with the exception of Sammon. The construction of the building showed that, in case of an explosion, it was the best kind, by reason of nothing being thrown from it to endanger the lives of anyone near.

It was impossible to arrive at any decision as to the cause of the explosion. It would appear that Sammon was a careful, experienced man; also that the heating arrangements were quite satisfactory. One thing that may have been a factor in causing the explosion was the fact that the exploders were made up in the small room in the building. Another cause of the explosion may have been the lantern used for lighting the building. It is necessary on the night shift to use light of some kind, and the writer has always considered a lantern the safest light that can be used, with the exception of electric light properly installed. There are, however, dangers connected with the use of electric light, which probably balance those connected with the use of a lantern.

Cobalt Station Grounds Silver Mine

At the Cobalt Station Grounds, on November 25th, Michael Nace, an Italian, about 24 years of age, fell down the shaft, and was killed.

Nace was employed at the Station Grounds as blacksmith's helper and general handy man. The property had been closed down for a few days, and work unwatering it was started on the night shift on November 23rd. On the morning of the 25th, the deceased was employed baling out the shaft, the water being within two and a half feet of the bottom. The captain had been underground until about 10.30 a.m., fixing a platform for the deceased to stand on. About 11.15 a.m., the deceased sent up a bucket of water, and, on the return of the bucket, got on and rode to the 150-foot level. He then climbed the ladders to the surface, told the deck-man that his feet were wet, and that he was going to change. The deceased, on his return, took the ladders to the 150-foot level, and the bucket was sent down to him there. After a short time, the hoist-man received two bells, and lowered the bucket about three and a half feet, when there was considerable vibration of the cable, and a heavy ring of one bell. The bucket was stopped, and, on investigation, it was found to be turned at an angle of about 45 degrees. Nace was found lying dead on the platform at the bottom of the shaft, having fallen a distance of about 50 feet. The bucket was held upright by a single snatch on one side. This was in proper working condition after the accident, but must have opened when the deceased got on the bucket at the 150-foot level. It was impossible to ascertain why the snatch was not fastened. It apparently was in proper position when the bucket left the surface It is possible that the deceased emptied the bucket before getting into it at the 150-foot level, and did not properly fasten the snatch.

The coroner's jury brought in a verdict of accidental death.

Cobalt Townsite Silver Mine

At the Townsite mine on December 15th, at 11.30 p.m., Wilfred Mandley, a Canadian, aged 23 years, was killed.

At the time of the accident the deceased was employed as a machine runner in a drift on the 200-foot level of the Cobalt Townsite mine. His helper was Archie Macdonald. On the night of December 15th, at 6 o'clock, Jesse Barker, machine runner on the opposite shift to Mandley, fired 14 holes in the heading of the drift in which Mandley was working. They had 13 reports, and marked on a board at the mouth of the shaft "one report missing in this heading." When Mandley and his helper went to work at 7 o'clock they read this message, and consequently were on the lookout for missed holes. They worked until about 11 o'clock, shovelling back from the heading. They then found two holes, which had apparently been cut-off, containing powder, and one back hole which did not break well. About this time Mandley gave an order for powder, and it was sent down by the nipper. This order was for two sticks of cheddite and three fuses and caps. The powder used in loading the holes was 40 per cent. dynamite for all but the sticks in which the primer was placed. This stick was cheddite. It is altogether likely then that the powder in the cut-off holes was dynamite. The reloading this night was done altogether by Mandley. The helper, Archie Macdonald, assisted him in getting materials, etc., but was not right at the heading. On account of the muck having been thrown back from the heading, there was a pile of it to within about three feet of the roof of the drift, necessitating a man crawling in on his hands and knees. Macdonald, the helper, was lying on this muck pile, while Mandley finished loading and started lighting the holes. The evidence given by Macdonald was the only evidence that could be obtained as to the method adopted by Mandley in loading the holes. He stated that one and a half sticks of cheddite were placed in the back hole, and that the other half stick of cheddite was cut in two, one part of it being used to hold the primer for one cut-off hole and the rest of the stick for the other cut-off hole. On account of the powder being flush with the collar of the holes, there was no room to put in the additional pieces holding the primers. Mandley, however, placed the piece holding the primer against the powder and held it in position by a small piece of rock. The fuse was six feet in length, and, according to Macdonald's evidence, only a few inches were cut off the fuse to fire the round in the proper order. When all the holes were loaded, a warning was given to the other men working near, and Mandley proceeded to light the round. He had succeeded in lighting two holes, and Macdonald stated that he had lighted the third and was turning to come away when the explosion occurred. Macdonald also stated that before the explosion he saw a flash of light from one of these holes, which would indicate that the powder caught fire. Mandley was instantly killed.

The doctor stated that death was due to the shock caused by the wound received in the explosion. The body of the deceased was badly lacerated on the left side from the head down, the internal organs in the central part of his body being exposed. Macdonald was slightly injured about the eyes.

The scene of the accident was inspected on Saturday night, December 16th, and it was found that there was still powder in two holes in the heading and fuse and cap in one of them. This was the back hole. The fuse in this hole was only about 18 inches in length. The other hole in which powder was left was apparently again cut off by the other blast. It is impossible to explain the short fuse that was found in the back hole. Macdonald swears positively that none of the fuses were less than 5 feet in length. However, the shortness of the fuse had nothing to do with causing the explosion. There was no tamping placed on the exposed powder to keep any spark from falling into it when the fuse was lighted. It is evident that, when the fuse was lighted, the fire from it spit into the powder, setting it on fire and causing the explosion. What makes this more probable is the fact that the powder was practically sticking out of the collar of the hole. A number of accidents are caused every year by similar neglect on the part of the miners to tamp their holes. There was no evidence whatever that pointed to the possibility of a quick fuse.

The coroner's jury brought in a verdict of accidental death.

Dome Gold Mine

At the Dome Mines on October 27th, Otto Nemine, a Finlander, 37 years of age, married, employed as machine driller, received injuries which caused his death on October 28th.

The deceased, with two other men, had been tramming in the No. 7 shaft, which was at a depth of 140 feet. This tramming was finished by midnight, and at 1 o'clock the men went down to blow out the rest of the holes which would be shot by the powderman within the next hour or two. The powderman first shot 12 holes in the No. 6 shaft, 100 feet distant, which was about 110 feet in depth. The jar of these shots caused a rock to drop in the No. 7 shaft, fracturing the skull of the deceased. The shaft was timbered to within about 40 feet of the bottom.

An inquest was held at Cobalt on November 10th, and the coroner's jury brought in the following verdict: "We find that the deceased died from a fracture of the skull, caused by a falling rock in what we consider an unsafe shaft."

At the Dome Mines on December 9th, Marvin Sommers, a laborer, was killed.

The deceased was a Canadian, about 56 years of age, and had been employed at the Dome Mines since the 13th October, 1911. On the day of the accident he was working under labor foreman F. B. Henderson, who had instructed Sommers and five or six Italians to carry over several pieces of shafting and pile it up, so that it would not become covered by snow. In order to keep this shafting off the ground, Sommers spiked a piece of 2 by 4 inch scantling against the building about 24 inches from the ground, holding up the other end by spiking it to a pole. In spiking this scantling to the building six 4 inch spikes were used. The shafting that was being piled was three inches in diameter, about 15 feet long, and would weigh about 500 pounds. The accident occurred about 4.20 p.m. Six pieces of the shafting had been piled on this scaffold nailed to the building, one end of the shafting being on the ground. When the six pieces of shafting had been placed on this scaffold, and the men started back for the other, Sommers apparently slipped and fell with his head under the shafting. The spikes holding the scantling to the building pulled out, allowing the shafting to fall to the ground, crushing Sommers under it and breaking his neck. He died almost instantly. The ground was covered with a little snow and it was quite mild at the time of the accident, which would make it slippery where these men were working. It is also probable that when Sommers slipped his shoulder struck the upright of the scaffold and assisted in causing it to fall. This kind of scaffold was hardly the proper one for holding up shafting of this weight, but no accident could have been anticipated. Sommers was apparently the only man on the labor gang that was familiar with English, and the orders were consequently given to him by the labor foreman, and he built the scaffold on which the shafting was placed. Henderson, the labor foreman, was not present at the time of the accident.

Drummond Silver Mine

At the Drummond mine on September 29th John Kaliska, hammer-drill man, was killed while loading a hole in the stope, through an accidental explosion of dynamite.

The deceased was working alone when the explosion occurred; a man was taking samples 30 feet north and three muckers were at work 30 feet south. The deceased had drilled 15 back holes and had taken 40 sticks of dynamite and 15 fuses with which to load these holes. Twelve holes had been loaded, and while in the act of loading the thirteenth or fourteenth hole the explosion occurred. From the wounds on the body it would appear that the deceased was looking up at the time and was grasping the tamping stick with both hands. The tamping stick was of hardwood, and the broken pieces of it were afterwards found. The explosive used was 40 per cent. dynamite and the size of the cartridge ⅞-inch.

The coroner's jury returned a verdict of accidental death, the cause of the explosion unknown.

It is impossible to ascertain the cause of the explosion. It is probable that the deceased may have been putting the exploder into the hole, with the cap projecting from the stick of powder, the friction against the rock causing it to explode. There was, however, no evidence to show that such was the case.

Foley-O'Brian Gold Mine

At the Foley-O'Brian shaft on June 25th Giovanni Gentile, an Italian machine helper, was killed by falling from the bucket.

The deceased was working in a drift in the No. 2 shaft, which was 160 feet in depth. Two missed holes had been fired about two hours before the accident, and the deceased had gone underground before the other men and began shovelling back preparatory to setting up his drill. He apparently became sick from the powder gas, and decided to go to the surface. He went to the station, got on the bucket, and, when about 70 or 80 feet from the bottom, fell from the bucket, sustaining a fracture of the skull and of both legs and one arm. When the deceased, sick from the powder gas, was hoisted up to the warmer air, he probably became dizzy and fell from the bucket.

It was shown at the inquest that the men were violating the Mining Act by riding on the bucket. Owing to the fire at Porcupine shortly after this accident no action was taken against the company for violation of the Mining Act.

Helen Iron Mine

At the Helen mine on January 26th John Maki, Oscar Mantynen and John Thompson, machine men, were killed by a premature explosion of dynamite. The three men killed were Finlanders, who had been in the employ of the company for several years. Maki was 32 years of age, Mantynen 37, and Thompson 28. These men were engaged in sinking No. 2 shaft from the seventh to the eighth level, and were preparing to blast when the explosion occurred.

The shaft was all drilled out, and the men were ready to blast at 8 o'clock in the morning. Mantynen went up to get the powder and lowered two boxes in the bucket to the seventh level. He placed one box on the station and took the other box into the cross-cut, where he and John Maki started to make up the exploders. This cross-cut is from the end of the shaft and is intended to be used as a hoisting station for sinking the shaft to the lower levels. It is about 30 feet in length and six feet in width, and is driven through rock.

The partners of the men who were killed were Oscar and Victor Niemi, who were in the bottom of the shaft blowing out the holes, and Konsta Nynam, who was on the level, first helping Mantynen and Maki to make up the exploders, and then going to the bell cord to signal for Thompson, who was in the bucket taking up the lines.

The box of powder had been opened and a number of sticks taken out and placed on a board, so that they would be handy in putting the caps and fuse in them. The men, before beginning to handle the powder, stuck their candlestick into a box near, but far enough from the powder to be away from contact with it. Oscar Mantynen had a wooden stick, with which he was putting the holes in the powder for the caps, while Maki was greasing the fuse and caps. Konsta Nynam had left the men only about two minutes when the explosion occurred. The force of the explosion broke down the timber at the station level, one piece striking Nynam and falling across him, so that he was unable to get up until released by the rescue party. John Thompson, who was in the bucket in the shaft, was jarred from it by the force of the explosion, falling a distance of about 40 feet, from which injuries he died about six hours later. The men who were working in the bottom of the shaft were uninjured. Nynam, who was knocked down by the timber, was able to resume work in a day or two. The two men, Maki and Mantynen, were instantly killed.

A machineman, Appoloni Piazza, working on the seventh-level main drift, passed by Maki and Mantynen on his way to the level above, two or three minutes before the explosion, and asked them if they could let him have some powder. They replied in the negative. Piazza corroborated the statement of Nynam regarding the position of their candlestick and the nature of the work they were engaged in.

An investigation was made into the causes which led to the accident on February 21st. It is impossible to say what caused the explosion. Mantynen had the reputation of being most careful in the handling of explosives in the mine, and would not allow anyone to handle explosives near him without first placing his light in a safe position, and also using a stick for putting the holes in the sticks of dynamite for the fuse.

It would appear that the explosion must have resulted from some unusual sensitiveness of the dynamite. The dynamite used was 40 per cent., manufactured by the Standard Explosives Company. The caps were manufactured by the Dominion Cartridge Company, and graded as No. 4. The writer examined the explosive in use at the mine on February 21st but could see nothing unusual about it. There were no complaints from the men as to the condition and behavior of the explosive in use at the time of the accident.

At the same mine on May 22nd, Louis Niemi, a Finlander, aged 23 years, machine runner, was killed by falling down a raise and being buried in the ore.

The accident occurred at raise 4-B on the seventh level. The ore in this raise had become hung up through large pieces blocking up some distance above the level. The raise at the top had been breasted and was full of ore. Attempts had been made to cause the ore to run in the raise by blasting from the bottom, but without success. Work was then begun from the top of the raise and a 2-inch pipe was being driven through the material. It was intended to drop some dynamite down this pipe and get it as near where the raise was blocked as possible. A ladder was laid on the ore across the top of the raise, reaching from side to side. Louis Niemi was sledging on this pipe, and Oscar Boro was holding a piece of wood on the end of the pipe to protect the threads. The superintendent, A. Hasselbring, was standing over the raise, watching the men working. The ore became loosened from below, and the superintendent jumped clear of the raise, and Boro, who was on the ladder, stayed there. Niemi tried to get clear, but did not succeed, and fell into the raise with the ore. As there was considerable ore around the collar of the raise, which was ready to fall into it, it was dangerous to attempt to lower a man into raise to rescue Niemi, for fear of further falling material. His body was rescued by drawing the ore from the chute at the bottom of the raise. Niemi, however, was dead when taken out.

An inquest was held by Dr. McLurg at the Sault, and a verdict of accidental death returned.

At the Helen Mine, on September 18th, Vertillio Spinae, an Italian 18 years of age, bucket tender, was killed by falling with a car from the seventh to the ninth level. A four-compartment shaft was being sunk from the eighth to the ninth level, and a platform had been placed across under the two hoisting compartments on the seventh level, and hoisting from below the seventh level was done by means of a hoist placed on this level and with a bucket. A heavy door was hinged over the bucket compartment on this level so that it could be closed when the bucket was hoisted, the car shoved in on it, and the bucket dumped into the car. A guard rope was placed across the entrance into this bucket way. This guard was supposed to be kept in place when the door was opened into the shaft. The deceased was tending the bucket on this level. It would appear from the evidence taken at the inquest that the deceased pushed the car into the shaft and fell with it to the bottom, a distance of 140 feet, and was instantly killed. The deceased had been employed at this work for three days. He apparently forgot to lower the trap door when the bucket was hoisted and consequently pushed the car into the shaft.

The coroner's jury returned a verdict of accidental death, due to the negligence of the deceased, no blame attaching to the management of the mine.

Hollinger Gold Mine

At the Hollinger mine on March 27th, Alfred Dupuis was instantly killed, and Joseph Knash received injuries which resulted in his death on May 5th. Alfred Dupuis was a Frenchman about 25 years of age, and Joseph Knash a Polander 23 years of age.

Dupuis, with his helper Joseph Knash, had completed drilling a round of holes in this heading before 12 o'clock at night, and had blasted the cut-holes before going off shift at noon. After shovelling back, they found that these holes had not broken very well, and decided to reload them along with the rest of the round. Dupuis went to the thawing house at the surface for powder, and brought down about 90 sticks of powder and 18 exploders. He was helped in the loading of these holes by Knash. Knash claims that they tamped them all, he having made up a cartridge of the loose material for his partner to use as tamping. Dupuis then started to spit the fuse, using a short piece of fuse for this purpose Knash was standing back, counting the fuse as Dupuis spit them. He had counted eleven, when he saw the centre cut-hole catch fire and start to burn. He immediately called to Dupuis and then started to run from the drift. They got out 25 or 30 feet when the hole exploded, knocking both men down. Knash, however, managed to crawl on his hands and knees to the shaft, 100 feet distant, before the rest of the holes exploded. He was met there by the shift boss, George Schmelzle, who sent for assistance, and got Knash taken to the surface to be cared for by a doctor. The injuries of Knash consisted of broken femur of the right arm and a large number of small wounds in the back, caused by his being struck by the small pieces of rock sent out by the blast. When the mine captain. R. Richards, got underground, he and the shift boss managed to get in the drift, where they found Dupuis lying dead, his skull having been fractured by a piece of rock.

There is no doubt that the accident was caused by the failure of Dupuis to tamp the centre cut-hole. When he spit the fuse of the upper holes one of them must have spit fire into this hole, setting the powder on fire. This burned until the cap was reached, which exploded, setting off the rest of the charge. This is a type of accident that is altogether too prevalent, and must be attributed to the negligence of the workmen themselves. It was shown in this case that it was the order in the mine that all drill holes should be properly tamped before firing. It would appear that Dupuis had been carrying out these instructions fairly well, but neglected to do so in this one instance.

Millerett Silver Mine

At the Millerett mine, on March 8th, John Stephen Kennedy, aged 36 years, employed as shift boss, met his death by being overcome with fumes from blasting.

The deceased had been engaged in mining for about 17 years, and had occupied the position of shift boss at this mine for nearly two years. The accident occurred in the No. 7 shaft, which had a depth of 156 feet with levels at 70 feet and 150 feet. The inside dimensions of the shaft were 8 by 5 feet. At the 150-foot level a station had been cut and drifts started north and south of the shaft. The timbers reached within 10 feet of the level. At 6 p.m. on March 7th a round of 13 holes was blasted at the 150-foot level, and as no night shift was employed in this shaft, air had not been turned on to blow out the smoke, since it was Kennedy's intention not to do any more work on this level until about 9 a.m. on the 8th. The explosive used was gelignite, manufactured by the Hamilton Powder Company. When the shift went to work at 7 a.m. on the 8th, the drill runner and helper descended to the 150-foot level to see how the round had broken, and found the air very bad. They climbed at once to the 70-foot level and went to work there. They did not turn on the compressed air. At 8 a.m. Kennedy came to the shaft and went down to the 70-foot level, where he asked the machine men how the round on the 150-foot level had broken. The machine men told him they had been down, but there was so much gas they had to come up again. Kennedy said he would go down and turn on the air. He then left them and went to the trammers and told them to come down to the next level as soon as they had finished their work on the 70-foot level. This was the last seen of Kennedy until he was found unconscious at the bottom of the shaft three-quarters of an hour later by the trammers going down to work. They found him lying on the broken rock at the bottom of the shaft, bleeding from several bad cuts in the head. They also found that the valve had not been opened. Kennedy was at once taken to the surface and every effort made to revive him, but without success. He apparently went to the bottom of the shaft, without opening the air valve, attached the air hose in the north drift and started to climb the ladder to open the air valve, when he was overcome by gas and fell off the ladder. The doctor stated that death was due to asphyxiation.

The coroner's jury brought in a verdict: "That Stephen Kennedy came to his death from asphyxia, and no blame can be attached to anyone."

McKinley-Darragh Silver Mine

At the McKinley-Darragh mine on June 16th James Graves, machine runner, was killed.

The deceased was running a drill in a cross-cut on the main north drift of the 150-foot level. Daniel Kavanagh and James Brazeau were running hammer drills on this staging six feet above the level and about six feet from the mouth of the cross-cut in which the deceased was working. Brazeau was working about four feet from the end of the staging, and had drilled a hole about thirty inches in depth. He had just started drilling after changing the steel when the latter broke, throwing him and the machine backwards off the end of the staging, and causing the machine to turn completely over. The foot of the machine struck Graves on the side of the head, and fractured his skull, causing his death. Graves was standing just outside the cross-cut waiting for his partner to help him pick up their drill. He was at least ten feet distant from where Brazeau was drilling and about six feet below him. All the witnesses that gave evidence told the same story about the accident.

The coroner's jury brought in a verdict of accidental death.

Mond Nickel Company

At the Garson mine, January 29th, Otto Heinanen, machine-runner, was killed by falling into the chute of No. 32 stope, which is a small underhand stope between the second and third levels. Three machines were working in the stope the night of the accident. The men had finished drilling, and were loading the holes. Heinanen finished loading first, and started to walk around the stope towards the other machines. While walking around on the steep side of the ore pile, he either stumbled, or slipped and pitched headlong down the ore into the chute at the bottom, and fell through i to the level below. The coroner's jury brought in a verdict of accidental death.

At the same mine, on May 10th, John Reilly, machine-runner, 25 years of age, wa killed by being crushed under a falling rock. Reilly was working in stope 33, which is mined by means of a dry wall and filling system, and was filled with broken ore to about 40 feet above the level, with the roof of the stope not more than six to eight feet above the rock filling. The stope had been inspected by the shift boss, Alex. Polluck, abou 10 a.m., who had instructed Reilly to blast down a piece of rock when they fire that night. A Polander was employed breaking up large pieces of rock in this stope.

and had noticed a piece of ground that he thought was loose, shortly after the shift boss had been around, and called the attention of the machine man to it. Reilly looked at it, and said it was all right. The Polander, however, endeavored to take it down, and, when going into the mine after dinner, brought a gad with him to help in taking down this rock. He inserted this gad in a crack in the rock, and was pounding at it until 1.45 p.m. Reilly, in the meantime, went from this machine to take a look at the piece of ground that he had been instructed by the shift boss to take down. This piece was about 14 feet from where the Polander was working. In going back, Reilly started to walk directly under the piece of ground upon which the Polander was working. He had just got under it, when it fell. The piece weighed about 600 pounds, and, apparently, crushed his chest, as he died in a few minutes. Peter Charron, machine-runner, was working within 8 feet of this loose piece, and when scaling in the morning had considered it safe. The work that the Polander did on it, however, gradually loosened it. The coroner's jury brought in a verdict blaming Reilly for walking under the piece of ground that the Polander was attempting to take down.

Nipissing Silver Mine

At the Nipissing mine, on June 22nd, Victor Leino, machine driller, was killed.

The deceased, a Finlander 27 years of age, was employed at the Kendall shaft, running a hammer drill in the stope on vein 108, between the second and the third level. He had been hired by Capt. Jeffrey on June 19th, and worked Tuesday night, Wednesday night, and had started to work Thursday night. On Wednesday night, the deceased had, at the orders of the shift boss, Peter Landry, blasted eight holes at 12 o'clock. He reported one shot missing, and, when the shift boss visited the stope in the afternoon, he gave instructions to the deceased to fire this hole, which was a burnt-out one, with three others, when going off the shift. The deceased did so, and reported to the shift boss that he had received four reports. The shift boss, Peter Landry, turned in the blasting report for this stope that 12 holes had been fired, and 11 reports received. The day-shift boss, W. McComb, and Capt. Jeffrey inspected this stope early Thursday morning, and found the hole that looked as if it was a burnt-out one. They examined it, but could find no powder in it, and ordered the day driller to drill about three feet back of this hole. This was done, but no blasting was done by the day shift in this stope. The day shift had, however, drilled some four holes, in addition to two that had been left the previous night, making three rows of two holes each back of the burnt-out hole. The night-shift boss, Peter Landry, came in the stope about 7.30 p.m. and examined this hole that had been reported to him by the opposite shift, and, according to his evidence, told the deceased that it was a burnt-out hole, and not to drill near it; to set up his machine back of the three rows of holes that had been drilled, and to blast the other at 12 o'clock. The shift boss then went to lay out the work for the machine-man working at the end of the stope, about 30 feet distant. He had left the deceased only about three minutes, when he heard an explosion. Going back, he found Leino badly injured. He was taken to the surface, and Dr. Hair summoned. The doctor had the man removed to the hospital and operated on him, removing some of the fractured bone from the skull. He died, however, in about two hours. The doctor stated that his skull was fractured (the brain exuding), and that the fracture extended to the base of the skull.

On an examination being made into the cause of the accident, it was found that the deceased had started to drill in this hole that had apparently been a burnt-out one. After the explosion, the steel was found stuck in the hole, and the machine practically under it. There were no witnesses to be found that could corroborate fully the evidence of the shift boss, Peter Landry. Leo Cote, the machine runner working in the same stope, gave evidence that he had heard the shift boss tell the deceased that there was a burnt-out hole, and to drill about three feet back of it. The other witnesses called had apparently heard no conversation. Both the shift boss and the mine captain stated that they were sure that Leino knew English sufficiently well to understand the orders given to him. There must, however, have been some misunderstanding on the part of the deceased of the orders of the shift boss, or otherwise he would not have deliberately drilled into this hole, when told not to do so. The deceased had worked at the McKinley-Darragh mine from 19th April to 19th May, and he was regarded there as speaking English as well as the majority of Finns. Before being hired by Capt. Jeffrey, he told him that he had worked in the mines of Michigan for five years.

The coroner's jury brought in the following verdict: "Victor Leino met his death by drilling into a missed hole contrary to orders. We would recommend the employment of men who understand English when working at hazardous work."

Section 164, rule 9, of The Mining Act was violated, and as a result of this the accident occurred.

At the Nipissing mine on November 6th Peter Milensnic, an Austrian, was killed by the accidental explosion of dynamite.

The deceased was employed as a hammer-drill man in stope No. 148, worked from the Kendal shaft. When coming off work on the night of November 4th he shot 15 holes. On returning to work on Monday morning he found that three holes had been cut-off, one hole had blown out, and that one or two old bottoms would have to be fired again. Accordingly he procured the necessary explosives, and was loading the hole that had blown out when the explosion occurred that caused his death. The deceased was using 60 per cent., 1¼-inch dynamite, loading with a wooden tamping stick, his light being on the far side of the stope, and it is probable that the detonator was not in this hole, as the machine helper, about 30 feet distant, was watching him charging the holes and noticed three fuses hanging from the back, but did not observe any fuse hanging from the hole he was loading.

At the inquest held on November 8th the witnesses stated that the dynamite was in good condition and that the holes were of sufficient size to freely admit the cartridge. The coroner's jury returned a verdict of death due to accidental explosion; cause of explosion unknown.

It was impossible to ascertain the cause of this premature explosion. An almost similar accident occurred at the Drummond mine on September 28th, excepting that in the latter case 40 per cent. dynamite was used instead of 60 per cent. It is possible that the dynamite had been overheated at some time while being thawed, and was thus in a supersensitive condition.

Norrington Gold Prospect

On January 8th on mining claim T.R.S. 863, township of Deloro, Albert Brunette, hammer man, was killed and Fred. Carroll injured as a result of starting to drill into a hole that had been blasted.

The accident occurred in a pit about 15 feet deep. The day before the accident eight holes had been fired and only seven reports obtained. No sign of a missed hole could be found on examination, and it was thought that two holes had exploded simultaneously. On mucking it was found that one hole at the side of the shaft had only broken off the collar. No powder was visible in the part of the hole remaining. The explosive used was cheddite. After mucking out, drilling was proceeded with, Brunette and his partner working at one end of the shaft and two other men at the other, each putting in three end holes. Brunette and his partner were the last to finish and were alone in the pit. Brunette said they would drill an old hole a little deeper and fire it, to take a knob off the side of the shaft. Carroll cleaned out the hole, taking out about six inches of dirt, but seeing no sign of an explosive. Then they began drilling in it with Carroll turning and Brunette striking. After drilling a minute or so an explosion followed, which killed Brunette and injured Carroll.

Owing to the fact that there was no coroner in Porcupine no inquest was held, but an investigation was made into the accident by the Assistant Inspector of Mines.

Northern Pyrites Mine

At the Northern Pyrites mine on March 19th George Cavazza, an Italian, a shift boss, met his death by being overcome by dynamite fumes.

The accident occurred on the second level in a raise driven from a cross-cut midway between No. 1 and No. 2 shafts. This raise was up about 15 feet. Cavazza loaded and fired a round of six holes in this raise between 11 and 11.30 a.m., March 19th. About 2 p.m. he again went below and started up the pumps. Not returning to the surface, at 5 o'clock the engineer on duty notified Cavazza's brother-in-law, who went below to ascertain the cause of his delay. He did not find him the first time, and thought he must have come up the other shaft. He went down again and found Cavazza, sitting on timber in the raise about 15 feet above the level, unconscious. He was at once brought to the surface, and the company's physician worked on him for some hours without being able to resuscitate him. As March 19th was Sunday, Cavazza was the only person in the mine, and his movements are therefore not accurately known. He did not open the valve to blow air into the raise before going into it. When found he was sitting on the timber in a natural position, and it is assumed that he sat down here for the smoke to clear.

Owing to there being no coroner near the mine, the body was sent to Fort William, where an inquest was held on March 23rd, and a verdict of accidental death was returned.

Nova Scotia Silver Mine

At the Nova Scotia silver mine on May 23rd Aleck Szniter was killed by falling down the shaft.

The deceased was a German Pole, aged 35 years and married. He had been employed at the mine for about a month and as cage tender for two weeks. A sub-level had been driven about 25 feet below the collar of the shaft and an adit driven out to the rock pile on the surface. This rock was being hoisted and treated in the mill. The duties of the deceased were to take the loaded cars from the switch, about 80 feet from the shaft, to the shaft and send them up on the cage. He was then to wait until the cage came down with the empty, then take the empty out to the switch and return with the loaded car. Just prior to the accident the deceased had taken in a loaded car and sent it up. He immediately went back to the switch, got another loaded car and took it into the shaft, not waiting for the cage to come down, as was the custom. This was the last seen of him until he was found by the men working near, lying on the sixth level, very seriously injured. Wm. Ade and Allan McWatters, timbermen, were working about 75 feet from the shaft on the sixth level, just about 70 feet below the level where the tramming was being done. They were interrupted in their work by hearing a noise which sounded like falling rock. They did not know at first where the sound came from, but, after it stopped, they went out to the shaft and found the deceased lying about five feet from the entrance to the shaft and the car wedged in the shaft just below the entrance. On examining the injured man they found him severely cut about the head. He was lying on one side, with his left hand grasping the handle of the hook used for throwing the cage chairs in and out of position. He was immediately taken to the surface, but died in about 15 minutes. The doctor stated that death was caused by fracture of the base of the skull.

At the inquest held in Cobalt by Dr. Hair on May 26th several witnesses were examined, but no direct evidence could be obtained as to how the deceased fell into the shaft, as he was alone there and not in sight of anyone. There was a chain used as a guard across the entrance to the shaft on the level, on which tramming was being done. This chain was in no way damaged, so that it could not have been in position when the man fell into the shaft. The cage was at the surface at the time of the fall, according to the evidence of one of the workmen who rushed into the shaft on hearing the noise. The hook, which the deceased held in his left hand, is always hung on a nail outside the entrance to the shaft. In order to have taken hold of this in the way he did, he must have stopped the loaded car near the entrance to the shaft, have gone round in front of it and have taken the hook off the nail. There was no evidence to show whether the man fell into the shaft before or after the car. It is probable, however, that the fall was caused through the deceased leaning out in the shaft, possibly looking up to see if the cage was coming, when, losing his balance, he with one hand grabbed the car, which, being near the entrance and not fastened, ran into the shaft. The man in falling apparently struck on one of the shaft timbers, which threw him out on the station level. The shaft was about 80 feet deep below the sixth level.

The coroner's jury brought in a verdict: That Aleck Szniter came to his death through falling down the shaft at the Nova Scotia mine on May 23rd; cause unknown.

Richardson Feldspar Mine

At the Richardson feldspar mine on November 9th Michael O'Connor, a Canadian, aged 34 years, unmarried, was killed by falling down a stope.

O'Connor had worked at this mine at intervals for the past six years, and had been running a machine drill for from two to three years. On the morning of the accident, assisted by Archibald McGowan, his helper, he drilled two 10-foot holes, and had set up on the third hole, when the superintendent, M. J. Flynn, ordered them to tear down to blast. The bench on which they were working was from six to seven feet in width and about 10 feet from the bench below, the stope being carried in benches. They took the machine drill off the tripod and, with the assistance of two Russians, carried it up the stope to the bench above. The weights were also taken off and laid away. They then started to take the tripod down by pulling it out from where it was set up. O'Connor ordered the hip to be loosened by McGowan, the two Russians holding one of the legs of the tripod. When this was done O'Connor called all three of the men to let go, which they did. Apparently at the same time O'Connor stepped in front of the tripod and slipped. In falling, he grabbed the tripod, and carried it off the stope with him. He fell to the bench below, a distance of about 10 feet, on his left side, the tripod falling on him. As a result of the fall O'Connor sustained a fracture of the skull, which caused his death about an hour afterwards.

The tripod weighed about 100 pounds, so that it could easily have been handled by the four men present. When the leg of the tripod was loosened, it made it very unwieldy.

Through lack of knowledge of the law on the part of coroners Mundell and Geddes no inquest was held, but an investigation was conducted by the writer.

Silver Leaf Silver Mine

At the Silver Leaf shaft, operated by the Crown Reserve Mining Company, on December 21st, J. Graham, a Canadian, 44 years of age, and married, was killed through falling down the shaft.

The deceased had been employed as deck-man at the Silver Leaf shaft for about three weeks. This shaft is 500 feet in depth, and hoisting is done by means of a cage. It has been the custom of the hoist-man when hoisting rock to oil the friction of the hoist about three times in ten hours. When the cage is on the chairs at the station, the cups to oil the friction are on the lower side of the drum, and the cage has therefore to be raised half a revolution on the drum, or lowered half a revolution, to bring the oil cups in a convenient position for filling. On the night of the accident the friction was oiled at 10 p.m., and about 1.30 a.m. the hoist-man, according to his own evidence, told the deceased that when the cage came up the next time he was going to oil the friction. When the cage came up he again told the deck-man, and requested him to be sure to put down the shaft-guard. The shaft-guard consisted of a bar of iron 1½ inches wide by ¼ inch thick and was fastened to one side of the shaft by a lag screw. The hoist-man stated that after the car was taken off the cage he heard the shaft-guard drop. He then hoisted the cage half a revolution of the drum. The deceased took the car of rock out to the dump, emptied it and returned. He evidently thought that the cage was back in position or forgot for the moment that the hoist was being oiled, as he wheeled the car into the shaft and followed it to the bottom. He was instantly killed. On examination of the shaft-guard after the accident it was found that the lag screw was pulled out. If the guard-rail had been in proper position it would have been impossible to push the car into the shaft. The guard-rail was probably dropped, but did not fall into its proper position, and was struck by the car while it was being shoved into the shaft, tearing out the lag screw to the position in which it was found.

The coroner's jury brought in the following verdict: "That J. Graham came to his death by falling down the shaft at the Crown Reserve mine Thursday morning, 21st day of December, 1911, by an accident caused by the deceased failing to place the guard-rail in its proper place."

Temiskaming Silver Mine

At the Temiskaming mine on March 16th Albert Sullivan, drill runner, met his death by being overcome with powder gas.

Sullivan and J. B. Brown, another drill runner, with their helpers, were working at the bottom of an incline winze 75 feet below the 500-foot level. Drifts were being started from the bottom of the winze north and south. On the morning of the 16th the two machine men mentioned above loaded 20 holes, 10 in each face, using 7-foot fuse for each hole. Hoisting from the winze was carried on by means of a small hoist placed near the mouth of the winze and operated with compressed air. It apparently was customary at the mine to permit the steam to go down in the boilers about 5 o'clock, in order to allow the firemen to clean their fires. On the morning in question, after the two machine men had their holes loaded, the hoist-man at the winze told the machine men that he would not answer any blasting signal until he found he had sufficient air pressure to hoist them. He went to the nearest gauge at the 400-foot level and found it registered 50 lbs. Here he met Jempson, the powderman, who said he would go to the surface and tell the engineer to keep the compressor running, as they were going to blast in the winze. Jempson went to the surface and saw engineer Henry, who told him the air pressure was down to 30 lbs. and the compressor just turning over, and that he could not get the air up in time to pull the men out of the winze. Jempson answered that he would close the valves at the 400-foot level, where they were blowing smoke, and try that. This was the evidence given by engineer Henry and his oiler. Jempson, however, gave evidence that Henry told him to go ahead and he would keep the compressor running. Jempson then went below to close the valves at the 400-foot level, and told the machine men that it was all right, to go ahead and blast. Sullivan and Brown then went down in the bucket to light their holes and gave the blasting signal, which was answered by the hoist-man. They then lighted the holes and gave the signal to hoist. The hoist-man tried to raise the bucket, but found that he had no air and could not do so. He called to the men that there was no air and to try and climb up by the rope, as there was no ladder in the lower part of the winze. The men started up, holding on to the rope with one hand and to the skids with the other. About 30 feet up Sullivan stopped on a stull, apparently exhausted, saying that he would stay there. Brown continued up the rope to a bulk-head about 45 feet from the bottom from which there were ladders to the level. The blast in the winze went off just as Brown reached the bulk-head. He, however, managed to climb up the rest of the way, Sullivan remaining on the stull. On account of there being no steam, it was impossible to get the winze clear of gas and get down into it for about two hours later, when Sullivan was found lying dead at the bottom of the winze. He had apparently been overcome by the gas while lying on the stull and had fallen to the bottom. Death was due to asphyxiation. There was no ladder in the winze for the last 40 feet, as required by section 164, rule 23, of the Mining Act. Had there been a ladder Sullivan would doubtless have escaped. The reason given for having no ladders was that all blasting in sinking was being done by electric battery, and orders had been given that no fuse was to be used. Sullivan and Brown, however, had obtained fuse from the powderman and used it, not only for this round but for the round preceding this one fired by them. This was apparently done with the knowledge of the shift boss, William Stephenson, but not with the knowledge of the mine captain, William McVichie.

The coroner's jury brought in the following verdict: "That Albert Sullivan came to his death in a winze at the Temiskaming mine Thursday, March 16th, 1911, as a result of gas from powder, having been unable to reach the ladder above. We are of the opinion that, had a ladder been there, the accident would not have happened. We find Stephenson, the shift boss, negligent for not enforcing the captain's orders, and find the captain equally negligent for not having a ladder at the bottom of the shaft to provide an auxiliary means of escape. We recommend that the captain shall have charge of all engines and give all orders regarding the time for starting and stopping compressors."

Information was laid before Magistrate Atkinson at Cobalt against the Temiskaming Mining Company and the shift boss, William Stephenson, for violation of section 164, rule 23, of the Mining Act of Ontario. Convictions were recorded in each instance, the company being fined $100 and costs, and the shift boss $50.

Metallurgical Works

Algoma Steel Company

At the blast furnace of the Algoma Steel Company, Sault Ste. Marie, on July 15th, Geraldi Vinzinzi, an Italian, was killed by being run over by the yard engine.

The deceased was a laborer, employed around the yards of the blast furnace. On the day of the accident he was sent by the foreman, Dugald McArthur, to take the hose and put out some fire. McArthur was with him at the time. While at this work the yard engine came along and struck both of the men, knocking down McArthur and running over Vinzinzi, injuring him so seriously that he died half an hour later. The accident occurred on the track just in front of the power house, so that there was considerable noise. The foreman stated at the inquest that he did not hear the engine coming. Neither of the men on the track were seen by either the engineer or the fireman on the approaching engine, according to their statements.

The coroner's jury brought in a verdict of accidental death.

The Steel Company of Canada

At the blast furnace, Hamilton, on October 10th. David Fe Duzzi, an Italian labourer, was killed.

It would appear from the evidence taken at the inquest that work at relining the furnace was in progress and that it had reached a height of about 35 feet. In order to handle the brick and fireclay a temporary shaft was built up through the centre of the furnace. This shaft was about 30 inches square, and the brick and clay were hoisted in buckets through it. All the rest of the space in the furnace was filled up by a scaffold on which the bricklayers worked. On the night of the accident three men were employed at the bottom of the furnace filling the buckets, while other men were employed on the platform, 35 feet above, taking out the brick and handing them to the bricklayers. The accident was apparently caused by one of the bricklayers having been handed a broken brick. He threw it down on the platform and one part of it fell into the shaft falling to the bottom and striking Fe Duzzi on the back of his head, causing a fracture of the skull.

The coroner's jury brought in a verdict of accidental death.

Canadian Copper Company

At the smelter on January 16th, P. Pologseyk, a Polander, 28 years of age, single, employed as a tuyere puncher on the convertor, received injuries which resulted in his death on January 21st.

The deceased was apparently standing between two cars, resting on the draw-bar. The yard locomotive came into the converter building to pick up the cars, and as they were shoved together Pologseyk was caught, and received severe injuries to his thigh and abdomen which caused a serious hemorrhage. These injuries resulted in his death four days later. The deceased had been employed at the smelter for about three months.

The coroner's jury brought in a verdict that P. Pologseyk came to his death through his own inattention, by being caught between the couplings of cars.

At the smelter on March 26th Arthur Jennings, a Canadian, employed as tapper at the No. 1 furnace, was burnt to death through an explosion of the settler. The deceased had been employed as tapper at this furnace for over four years and had worked at the smelter for about ten years.

On the Thursday night preceding the accident a new tapping jacket had been put on No. 1 furnace. This tapping jacket was made of cast iron, with the tap hole water-cooled. In the construction of the settler it was found that the matte scoured away the lining in that part of the settler near the tap hole, causing frequent accidents through the matte eating through the wall of the settler. To overcome this difficulty, that part of the furnace round the tap hole was water-cooled by three coolers, one being placed on each side of the tap hole and one above it. These coolers are about 15 inches wide, 6 inches thick, and reach to the top of the settler, where the water connections are made. They are made of cast iron, having a coil through them, through which the water circulates. At the tap hole these coolers are from 10 inches to 11 inches apart, thus forming a square of about 11 inches. This square is filled with chrome brick, leaving a tap hole in the centre about 1½ inches in diameter. Inside the water coolers is a lining of chrome brick 18 inches thick. When the tapping jacket is burnt out, which occurs every seven or eight days, the chrome bricks in the square surrounding the tap hole are examined, and if scoured away to any extent are replaced. This can be done after tapping out the furnace.

Before the new tapping jacket was put on, on the Thursday night preceding the accident, the chrome brick surrounding the tap hole was examined by Cecheta Luigi, the tapper, and Judson Webb, smelter foreman. They both pronounced it in good order, the bricks not being worn away to any appreciable extent. Arthur Jennings came on shift on Sunday, March 26th, at 12 o'clock, and was informed by the tapper on the opposite shift that there was a leak in the tapping jacket and they were running it dry. Pat Sullivan, Jenning's helper, stated that they had run this tapping jacket dry after he came on shift, but they had sometimes turned on the water to cool off the tapping jacket when they were not tapping. Sullivan was holding the bud in the tap hole at the time the explosion occurred, a ladle full of matte having just been tapped off. The explosion threw him and Jennings back, the latter falling about 10 feet distant from the tap hole. The explosion was immediately followed by a rush of molten matte from the settler, which flooded the trough and flowed over Jennings before he was able to rise. Before anyone could come to his assistance he was completely surrounded and embedded in the molten matte. It was consequently some 15 or 20 minutes before they were able to get the matte sufficiently cooled to take him out. When they did so, it was found that his flesh was all practically cooked. The doctor stated that his death would be almost instantaneous.

The coroner's jury brought in a verdict of accidental death.

At the smelter on March 27th Volpini Attelio, an Italian, employed as converter puncher, received injuries which resulted in his death on April 5th.

About 5 p.m. March 27th the matte of No. 1 converter broke through at the back. The skimmer immediately rang the bell and the converter was turned down. The deceased was sent over to the furnace building for some fire clay, and on his return went up the ladder to the top of the converter to patch up this hole in the lining with the fire clay. He had finished this work, had thrown down the remaining fire clay to the ground and was just rising on his knees when a piece of matte and slag about 8 inches in length and 1¼ inches thick fell from the hood about two feet above him and hit him on the head. Attelio then came down from the top of the converter and went to the time office to get the foreman to fix him up. The foreman said he complained of a pain in the back of his head, but there was no bruise to amount to anything. He waited round until 6 o'clock, when he went to the hospital, where he was examined by Dr. McAuley, who told him to go home and stay there for a day or two. Dr. McAuley saw him again on the 29th March at his home. He found him vomitting, which was a symptom of fracture of the base of the skull. The man was then brought to the hospital but grew gradually worse, dying on Wednesday, April 5th.

A post mortem was conducted by Drs. Morrison and McAuley, who stated that they found three small fractures at the base of the skull. They found that the skull at this point was about one-third the normal thickness. The fracture had caused acute inflammation of the brain membranes.

The converter foreman, William Kent, stated that all the loose material which accumulated in the hood was cleaned out every morning at 7 o'clock and every time a shell was changed, but that no definite instructions had been given to the men to clean it out at all times before going under it. The hood had therefore not been cleaned out for ten hours.

The coroner's jury brought in a verdict of accidental death.

On August 15th, John Miesko was injured by falling through the roof of the converter building, dying next day.

The deceased had been employed by the Canadian Copper Company for upwards of four years, and had, during that time, been employed chiefly in laying tile on the roofs of the converter and other buildings around the plant. He was a Finlander, 31 years of age. On the morning of August 15th, he had been set to work on the east side of the converter building to take off the old tile that had become weakened through the action of the gases from the converter. These tiles are 4 feet 3 inches long, 2 feet wide, and 1¼ inches thick, and are laid on purloin plates, which are 3 feet 6 inches between centres. These tile, when new, are strong enough to hold the weight of a man, but, owing to their weakened condition, the deceased, assisted by Aleck Puponen and Antti Rauhanen, took up planks to lay over the tile to support their weight. The foreman, John Schofield, remained in the converter room to keep everything clear, so that they could throw down the defective tile. The deceased, according to the evidence of his two helpers, had lifted off one of the defective tile, thrown it down, and, in stepping back, put one foot off the plank on to the tile. His weight broke the tile, and he fell through to the floor below, a distance of 43 feet. He was at once taken to the hospital, where he was examined by Drs. Morrison and McAuley, who found that both feet and ankles were badly fractured, but no signs of other injuries. He was put under an anaesthetic, and the fracture reduced. He did not rally from the shock, and died at 3 a.m., August 16th.

The coroner's jury brought in a verdict of accidental death.

At the same plant, on October 28th, Ignatio Chiptomi was injured by falling from the top of the converter stand, dying on October 4th.

The deceased, a Polander, 29 years of age, and single, had worked at the converter plant for four months. On the morning of the accident, the converter had been turned down for the last time, preparatory to dismantling it, and Chiptomi climbed on the top of it, which was about 12 feet from the floor, to lower the hood. This hood is about nine feet long by four feet four inches wide, and weighs approximately 2,750 lbs. It is held in position by a bar of iron ¾ inch in diameter, passing through two hinges. It is impossible to say how long this bar had been in position, as the practice was to renew it whenever any sign of bending was apparent, which generally takes place in the centre, between the hinges. When Chiptomi released the latch, it fell into position, and then toppled over, striking the converter stand, and falling to the ground. The witnesses of the accident, Alfred Wuiff and John Suckon, crane men, were unable to see, on account of the dust raised by the hood in falling, whether Chiptomi was struck by the hood or not. His injuries, however, would indicate that he was not. No doubt, he lost his balance, and so fell off the converter stand to the floor, landing on a rail, and causing internal injuries, which resulted in his death.

The bar broke between the hinges on both sides. On the one side, it showed signs of shearing, and on the other, there was a clean fracture.

The pieces of the bar were subjected to a microscopic examination, and a shearing and tensile test by Mr. T. R. Loudon, of Toronto University. The microscopic examination showed the iron bar to be what is known as "bushelled" wrought iron and the metal to be extremely dirty, with high carbon areas almost entirely separated from the rest of the metal by a surrounding fence of slag. The section taken nearest to the point of failure was worse than any other part of the metal examined. The result of the shearing test showed a single shear 41,000 lbs. per square inch. The tensile test was as follows: Elastic limit, 31,000 lbs.; ultimate strength, 41,600 lbs. Both the shearing test and the tensile test gave good values, but it is well to point out that this type of metal should not be used where the metal is to be subjected to any considerable stress.

The coroner's jury brought in the following verdict: "That Ignatio Chiptomi came to his death by either jumping or falling off a converter on October 28th, causing internal injuries."

Mond Nickel Company

At the power house of the smelter, at Victoria Mines, on August 4th, Charles Longfellow, engineer, was killed through coming in contact with a high-pressure wire, situated back of the switch board. The deceased was a Canadian, 53 years of age, and had been employed as engineer in the power house about a month. The place where the accident occurred was back of the switch board, where a 15,000-volt wire, leading to the oil switch, came in a vertical position from the main wires, about 10 feet high to within four feet of the floor, where a bend was made in it, so that it ran in a horizontal position for about 18 inches to this oil switch. The deceased had apparently gone to the back of the switch board for some reason unknown, and had stooped down in the corner under this high pressure wire. In raising, his head had come in contact with it, and he was was found some time afterwards lying on his face in this corner. The doctor stated that death was due to an electrical shock, as there was a mark on the back of his head and on his left elbow, where the current had made a connection with the concrete wall. There is no doubt that the deceased had no business in this part of the power house, but he had never received explicit instructions not to enter it. The only indication of danger was a sign board, "Danger, 15,000 volts."

The coroner's jury brought in the following verdict: "That the deceased, Charles Longfellow, came to his death, August 4th, 1911, by coming in contact with a live wire behind the switch board in the power house of the Mond Nickel Company, at Victoria Mines, and being electrocuted. They further find that the said wires were insufficiently guarded to protect a person from shock."

Coniagas Reduction Company

At the Coniagas Reduction works, at Thorold, April 26th, William Allen, carpenter, was injured, dying as a result of the accident on April 28th. The deceased was a Canadian, 54 years of age, and had worked at his trade as carpenter the greater part of his life. He was engaged along with William Rapsy in putting paroid roofing on a building to be used as a silver refinery. To enable them to get to their work, a scaffold had been erected, which was about six feet from the ground. It was built of two jacks, held in place against the wall by short pieces of scantling. On these jacks was a plank 2 inches by 10 inches by 14 feet. The two men had been working on this scaffold for about fifteen minutes, when one end of it suddenly slipped. Allen was standing on this end of the scaffold, and fell with it, lighting on his hands and knees. He was apparently struck on the back by the falling plank. Rapsy was standing at the middle of the scaffold, and received no injuries. Doctors McDonald and Harvey made a post mortem examination, and found that the cause of death was the displacement of the vertebra, which had flattened the spinal cord. The accident was caused by the slipping of the scantling, and holding up one of the jacks. Apparently no hole had been made for this scantling, and no brace put against it to keep it from slipping. The coroner's jury brought in the following verdict: "That William Allen came to his death from injuries received through being struck by a falling scaffold, not properly erected, at the works of the Coniagas Reduction Company, Thorold."

Stone Quarries

Doolittle and Wilcox Stone Quarry

At the Doolittle and Wilcox quarry, near Dundas, on March 28th, Louis Pace and Midio Toro, Italian laborers, received injuries which resulted in their death. The injured men were in a car on a siding unloading fines. The siding at this point is on a fairly steep grade. One of the shippers was letting down a load of stone from the bins, when, in some way the car got away from him, and crashed into the car in which the men were working. Toro fell under the wheels, and was instantly killed; Pace fell under the car, and the wheels passed over his leg. He died a week later, as a result of his injuries. The men apparently had been instructed not to get into the car until a loaded car with brakes set had been placed ahead of it, so as to prevent an accident. Through some misunderstanding, the men received an order to unload the car. When the car that caused the collision was started down the grade, it was seen that the brakes would not hold it. After it gathered headway, the man on the car found it impossible to check its speed and jumped off.

An inquest was held at Dundas, on March 31st, and a verdict returned censuring the Company for carelessness in the operating or shifting of cars.

At the same quarry, on September 22nd, Ernest Findlay met with his death by being crushed between two engines.

On the morning of September 22nd, No. 1 engine went off the track, near the switch. No. 3 engine was run down on the track running to the switch, with the object of pushing No. 1 engine back on the rails. To accomplish this, Ernest Findlay and C. Gravelle placed a tie between the bumpers of No. 1 and No. 3 engines, and No. 3 engine was moved up until this tie was tight. No. 3 engine was then stopped, and the men were told to step back clear, as the tie was apt to break or slip. The engineer of No. 3 engine, Jim Borman, received a signal to move forward. He did so, and the tie slipped, and Findlay, who had apparently not stepped clear, was caught between the bumpers. He was quickly released and taken to the hospital at Hamilton, but died the same day.

Findlay was a Canadian, about 35 years of age, and unmarried. He was usually employed as a drill runner, but, on the day of the accident, was helping at the crushers. When the engine went off the track, he came up to give assistance in replacing it.

The superintendent, James Small, was present at the time of the accident directing affairs. The evidence shows that he had warned the men to step clear when the No. 3 engine started to put pressure on the tie. The engines are of the small contractor's type for narrow-gauge railway.

An inquest was held in Hamilton by Dr. Rennie on Monday night, September 25th. The coroner's jury brought in a verdict of accidental death.

Hagersville Stone Quarry

At the Hagersville quarry, on April 19th, George Arthur Howard, engineer, was injured by being struck with a rock thrown by a blast from the quarry, dying as a result of his injuries on April 24th.

Howard was at work in the boiler house shovelling coal, when a rock came through the building, striking him on the head, and fracturing his skull. The boiler house was a skeleton frame, covered with 1-inch lumber, and consequently afforded no protection against falling rocks from blasts. The blast fired on the night of the accident was for the purpose of breaking up a large piece of rock. As a result, there would be more danger than usual of fragments flying great distances. A warning cry was apparently given before the blast was put off. The boiler house was about 140 feet from where the blasting took place.

An inquest was held at Hagersville, on April 27th, and a verdict of accidental death returned.

MINES OF ONTARIO

By E. T. Corkill, Chief Inspector of Mines

1.—NORTHWESTERN ONTARIO

There was little change in the condition of the mining industry in northwestern Ontario in 1911 from the preceding year. A number of properties were worked for gold, and a small production was recorded. These operations were widespread, and include properties on the Lake of the Woods, near Dryden, Upper Manitou lake and Sturgeon lake.

On the last-named area, where gold discoveries were made and many claims staked in 1899 and subsequent years, there was much activity in 1911. The St. Anthony mine is the most important property in this area yet discovered, and has been worked intermittently since 1899. The property was purchased from the former owner, the St. Anthony Gold Mining Company, by the Sturgeon Lake Development Company, of which Mr. Geo. Glendenning is president, in March, 1911, and active development work has been carried on since that time. The acquiring of this property caused a revival of interest in the area. A number of claims were staked, old properties examined and assessment work done.

In addition to gold mining, other minerals produced were silver, iron and iron pyrites. Although the Port Arthur silver area was formerly a large producer, there was but little actual mining work done in 1911. The Atikokan Iron Company shipped steadily most of the year to their blast furnace at Port Arthur. The Northern Pyrites Company shipped iron pyrites during the season of navigation from their mine near Graham.

Quarries were operated in the Port Arthur area and at Hawk Lake station, near Kenora. On account of the lack of available building stone of good quality in the Province of Manitoba, and its occurrence in this part of Ontario, quarrying should become an important industry.

Lake of the Woods Area

Mikado Gold Mine

Mining was carried on at this time by the Kenora Mines, Limited, during the first half of the year. This consisted chiefly of development work on the second, fourth, and seventh levels. A winze was sunk from the fourth level a depth of about 90 feet. The mine is kept unwatered, but no mining is at present being done.

Cameron Island Gold Mine

Several examinations were made of this property during the year, and preparation for a mill is now under way.

Olympia Gold Mine

Work was resumed at this property, which is about half a mile from the Mikado, late in 1911. Operations consisted chiefly of surface work.

Ophir Gold Mine

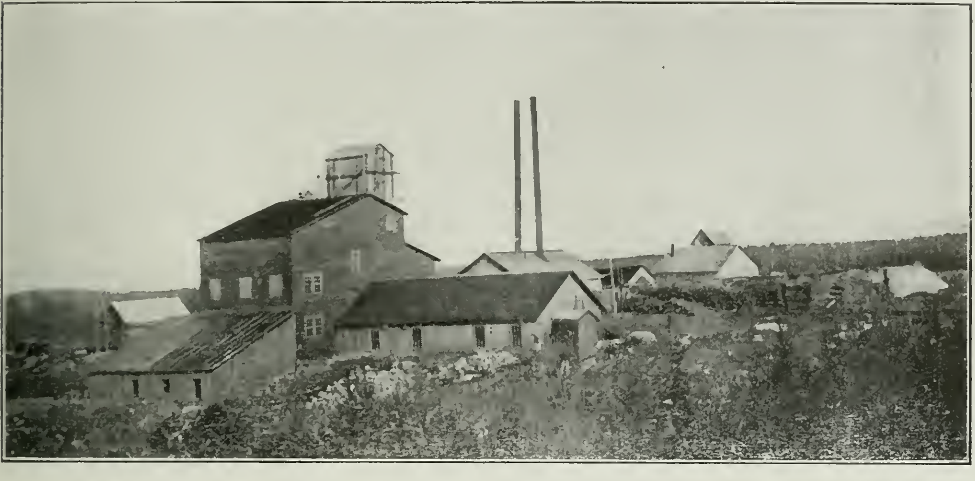
This property, situated about half a mile south of the Sultana mine, was re-opened in 1911. A shaft was sunk a depth of 50 feet, and 100 feet of drifting done at this level. The mine is in operation under the management of R. B. Nickerson.

Scramble Gold Mine

This property, located in 1894, is situated on lots 13 and 14 of the sixth concession, township of Jaffray, a few miles north of Kenora. After remaining idle for about thirteen years, work was resumed on this property the latter part of the year by Chas. Brent.

Allie Island

On claims staked for copper by T. W. Moore on Allie Island, about fourteen miles from Kenora, assessment work was done during the year. Several test pits have been sunk.



Stamp mill, St. Anthony gold mine, Sturgeon lake.

Camp buildings of St. Anthony gold mine.

Dryden Area

On a number of gold claims in this area, development work was carried on during 1911, but no extensive mining work was done. At the League mine, worked by the Shareholders' Protective League, Limited, the shaft was sunk to a depth of about 80 feet. Messrs. Hutchinson and McPhail, of Dryden, did some development work on claims in the township of Van Horne.

Upper Manitou Lake Area

Very little work was done in this area in 1911, and the properties were consequently not inspected. During the latter part of the year, work was resumed on the Laurentian gold mine, which had been idle for about two years. The Big Master gold mine was pumped out for an examination. Messrs. John Beck and Dryden Smith did some development work on a gold property known as the Last Chance.

Sturgeon Lake Area

Development work was carried on on a number of gold properties on Sturgeon Lake during the summer, but only the St. Anthony and the Rainbow were inspected.

St. Anthony gold mine.

St. Anthony

The Sturgeon Lake Development Company, under the management of J. Houston, have been actively engaged in mining on this property since March, 1911. Considerable development work had been done by the late owners, and a tonnage of ore stoped and milled. The ore milled came largely from the open cut, south of the main shaft. The latter is 100 feet deep, with drifts run north 200 feet, and south 400 feet. At about 100 feet south of the shaft on this level, a winze has been sunk 80 feet, and a cross-cut is being driven to the shaft, with the intention of raising. Stoping is being done on the vein north, and also south, of the shaft. The vein has been open-cut south of the shaft to the first level for a length of 150 feet. A cross-cut is being driven to the parallel vein, east of the shaft. This has a length of 160 feet. A cage has been installed.

The plant consists of two 100-h.p. boilers, compressor, 10-stamp mill, Hardinge pebble-mill, crusher, and hoist. A new power plant, consisting of boilers and compressor, is being installed.

The mill was put in operation in August, 1911. A road was built to the National Transcontinental Railway, a distance of about twelve miles, and supplies brought in over the road, after the close of navigation. About sixty men are employed.

Rainbow

On A.L. 499, formerly owned by T. K. Barnard, situated on an island about one-half mile from the Sturgeon Lake Hotel, a shaft has been sunk 50 feet, and 20 feet of drifting and cross-cutting done. There is no plant on the property.

Other Areas

Chimney

On H.W. 113, adjoining the townsite of Graham on the shore of Pelican lake, a pit has been sunk on a narrow quartz vein by J. Tingley. The management purposed installing a 2-stamp mill during the winter.

Quartz vein, St. Anthony gold mine.

Elizabeth

The Elizabeth mine is situated at the north end of Rice lake, four miles west of Steep Rock lake and two miles north of the Canadian Northern Railway, from a point five miles west of Atikokan Station. The mine was originally owned and operated by the Anglo-Canadian Gold Estate, Limited, but has not been worked for about ten years. It was re-opened during the latter part of 1911 by Mr. W. H. Nelson, and is being operated by him.

The old shaft was 240 feet in depth, with the first level at 65 feet. The present operators are working on this level.

The plant consists of two boilers, a 35-h.p. and a 70-h.p., a compressor, and hoist.

Northern Pyrites Mine

During 1911, the Northern Pyrites Company were actively engaged in development work, and, during the season of navigation, were steadily shipping ore by way of their aerial tram to the National Transcontinental railway, and thence to Fort William. No. 2 shaft, in the foot wall of the ore body, has been sunk to the third level. No. 1 shaft was started in the hanging wall and sunk vertically to a point midway between the second and third levels, where it encountered the foot wall, which it followed to the third level. From No. 1 shaft in this wall, a cross-cut, 60 feet in length, has been driven across the ore body, and a drift run along the foot-wall side of the deposit for a distance of 200 feet towards No. 2 shaft. At No. 2 shaft a cross-cut has been driven to and across

Northern Pyrites mine, Vermilion lake.

Ore crushing plant, Northern Pyrites mine.

the ore-body, and drifts started on the ore. On the second level, the shafts have been connected, and the drift continued east to a distance of 400 feet from No. 2 shaft. No. 1 stope has been started east of the shaft. This stope is 70 feet in length by the width of the ore body. No. 2 stope is midway between the two shafts, and is 60 feet in length, which is the width of the ore body. This stope is started by first driving a cross-cut through the ore body, and then raising from intervals along the same. A floor with a thickness of at least 10 feet is left over the cross-cut, and these raises are used as chutes for drawing off the surplus broken ore as stoping progresses. The same principle is used in No. 1 stope, except that it is along the ore body, instead of across it. No new work has been done on the first level.

Atikokan Iron Mine

This mine was operated continuously during the year, but, at the time of inspection, in October, only twenty men were employed, chiefly in stripping and development work. At No. 1 tunnel, the open stope has been carried back east and west of the tunnel, a distance of 100 feet and 150 feet respectively, and the full width of the ore body. The work of stripping the ore body on the north side of the ridge, putting in pocket, and taking down wall rock, preparatory to open cutting, was in progress. The tunnel is being widened. No. 2 adit, 450 feet east of No. 1 tunnel, has been driven to the north wall of the north vein, a distance from the mouth of 140 feet. The south ore body has been open-cut for a length of 75 feet. No. 3 adit has been started 400 feet east of No. 2. The surface plant remains the same. Mr. F. Rodda is superintendent.

Atikokan Blast Furnace

The Atikokan Iron Company operate both the mine and the blast furnace. The blast furnace, located at Port Arthur, was in blast the greater part of 1911. It was closed down in October for the purpose of relining. Mr. J. D. Fraser is manager.

Port Arthur Silver Mines

As in 1910, but little work was done at these mines during 1911. The Three A mine, discovered in 1870 and worked for a few years, was reopened by Messrs. Stewart and Skene. This mine is on the north shore of Thunder bay, about 12 miles east of Port Arthur. The old workings were unwatered and about 200 feet of drifting and cross-cutting done on the first level to pick up the vein. Work was suspended here in October.

At Spar island, about 20 miles southwest of Port Arthur, R. A. Lockerby has been engaged in exploratory work for a Montreal syndicate. A shaft has been sunk about 75 feet, and work was still in progress in October, but was not inspected.

Quarries

Midway between Port Arthur and Fort William, and two miles from the lake, Messrs. Stewart and Hewitson are operating a stone quarry. They are chiefly producing crushed stone for concrete work and road material. A crushing plant has been erected at the quarry, and the crushed material is hauled by wagon to the place where it is used.

At Hawk lake station, Canadian Pacific railway, 25 miles east of Kenora, a granite quarry has been opened up. Stone from this quarry was used in building the court house at Kenora, and it is also being shipped to Winnipeg.

II.—SUDBURY AND THE NORTH SHORE

This is one of the most important mining areas in Ontario. In addition to producing most of the nickel used in the world, it yields also copper iron and gold. This area possesses, too, the advantage of splendid waterpowers, assuring a low cost for power which would otherwise be high if it were necessary to use coal. The power costs for this area range between $16 and $20 per horse power year. All the producing mines here are now using electric power obtained from near-by waterpowers. The principal power companies are: the Huronian Power Company of the Canadian Copper Company; the Lorne Power Company, a subsidiary company of the Mond Nickel Company; the Wahnapitae Power Company, which sells power to the Mond Nickel Company; the Canadian Exploration Company, the Dominion Nickel Copper Company and Moose Mountain, Limited; and on the east shore of Lake Superior, the Algoma Power Company, supplying power to the Helen and Magpie iron mines. Further power development is in progress by the Wahnapitae Power Company on the river of that name, about 10 miles below their present plant, and by the Lake Superior Corporation on the Magpie river, between the Helen and Magpie mines.

The nickel production comes from the mines operated by the Canadian Copper Company and the Mond Nickel Company. These companies have during the year begun development work on adjoining properties, called respectively the Frood and Frood Extension. The Dominion Nickel Copper Company carried on development work at their mine throughout the year. There was also considerable diamond drilling done on outlying properties by other companies.

Owing to the lessened demand for iron ore during 1911 the Moose Mountain mine shipped but little during the year. Work on the large concentrator was, however, begun, and the plant is now nearing completion. The Canadian Exploration Company at Long lake enlarged their mill, but, owing to lack of power, had but a small production. A power line has been built from the mine to the Wahnapitae Power Company's plant.

Sudbury was the starting point of a rush for gold into the West Shining Tree area. A large number of claims were staked during the latter part of the year. A winter road was cut into the camp and supplies hauled in for carrying on development work during the coming summer.

The main work being done in the Michipicoten area is at the Helen and Magpie mines. Shipments were continued from the Helen mine during the season of navigation. At the Magpie mine only development work underground is being done, on account of the necessity for roasting the ore. The first unit of the roasting plant is now under construction. The railway was completed to the mine during the summer. Diamond drilling is also being carried on at other properties in this area by the Lake Superior Corporation. Very little work was done on the gold properties during the year.

Canadian Copper Company

All the production of the Canadian Copper Company came from the Creighton, Crean Hill and No. 2 mines. Important changes have been carried out at the smelting plant, where basic converters have been substituted for acid converters, and two large reverberatory furnaces have been erected for treating the blast furnace flue dust, converter slag, and the green ore fines. The first of these furnaces was blown in in December, 1911.

An 8-hour day for all the workmen underground was adopted by the company the first part of 1912.

The chief officers of the company remain unchanged; Mr. A. P. Turner, president and general manager; Mr. John Lawson, general superintendent, and Mr. D. H. Browne, metallurgist.

Creighton

This mine is worked by two incline shafts 325 feet apart. No. 1 shaft has a dip of 59 degrees and is 300 feet deep. The part of the ore body served by this shaft has heretofore been worked by an open cut. This open cut on the surface has a maximum length of 650 feet and a maximum width of 400 feet, narrowing down to the third level, where its length is 300 feet and width 125 feet. The work of taking down the floor under the third level is now in progress. As the ore body dips to the north, it was found necessary to take down a large tonnage of rock off the hanging wall to provide for the safety of the workmen. No. 2 shaft has a dip of 46 degrees and is 500 feet deep, or a vertical depth of 350 feet to the fifth level, the deepest workings of the mine. The main workings served by this shaft are mined by the filling system, first inaugurated at the Crean Hill mine. This shaft also served for hoisting a considerable tonnage from the open cut. The main work at this shaft is on the third, fourth and fifth levels. On the third level there are two separate stopes, one 225 feet long and one 150 feet long. These stopes are 75 feet apart, but are along the strike of the ore body. The longer stope is, however, a part of the ore body that has been worked by open-cutting. On the fourth level similar stopes, but larger, have been opened up, and are being mined by the same method of back stoping and filling. The station at the fifth level has been cut, and the work of blocking out the ore bodies begun. An ore pocket has been built at the station at this level. The surface plant remains about the same. Owing to an accidental explosion, the thawing house for explosives at this mine was destroyed. A new thawing house has been erected, which embodies all the recognized safeguards for the prevention of accidents. Owing to the extreme cold of Northern Ontario winters it is necessary to have the heating pipes in the room in which the explosives are thawed. This may be a source of danger, but it seems impossible to avoid.

Mr. R. M. McAuley is superintendent, employing a force of 300 men.

Crean Hill

The main shaft at this mine has now reached the seventh level, a depth of 600 feet. Work is confined chiefly to the fifth and sixth levels, where the system of ore extraction is being followed described in former Reports. As the filling in these stopes is rock it is necessary to provide means for bringing part of this from the surface, where it is sorted from the ore. To accomplish this, raises were put through between the ore body and the shaft between the different levels. Three shifts of 8 hours each are worked at this mine, the men relieving each other at the working face.

Mr. T. Thoenen is superintendent, employing 150 men.

No, 2 Mine

This mine is the deepest operated by the Canadian Copper Company, the lowest level being at a vertical depth of 600 feet. Mining is being carried on, on the seventh and eighth levels. The ore body at this mine is chimney-like in form, being nearly vertical, and having a length of one and one-half times its width. The system of back stoping and filling adopted at the Creighton and Crean Hill mines is also used here. On the eighth level the section of the ore body is being cut. On the seventh the dry wall drifts have been completed, the ore has been broken down and the stope filled for 30 feet above the level.

Mr. J. Ovens is superintendent, employing a force of 100 men.

Frood Mine

At the Frood, or No. 3 mine, work was started again, no mining having been done since 1902. Several thousand feet of diamond drilling was accomplished during 1910 and 1911, and a large tonnage of ore blocked out. The new workings are situated west of the old shaft and open cut. Work was started on a 4-compartment shaft which has now reached a depth of 200 feet, where a station will be cut. A small plant has been used for this work, but it is proposed to instal a permanent plant during the present year. The company are also building a railway from Copper Cliff to the mine, which will be three miles in length. Mr. M. Pickard is superintendent, employing a force of 50 men.

Dill Quarry

The quartz quarry in the township of Dill has been operated continuously throughout the year, about 300 tons a day being shipped. The quartz is mined from an open pit about 225 feet long by 70 feet wide and 40 feet deep. This quartz is hoisted by means of derricks and dumped directly into railway cars, in which it is taken to Copper Cliff for use in the furnaces and converters.

The plant consists of two 125-h.p. boilers, a 6-drill compressor and hoists for each of the two derricks.

Quartz quarry at Dill, Canadian Copper Company.

Smelting Works

The blast furnace part of the works was in operation continuously throughout the year, and but little change was made in the plant. One of the changes made in the settlers was the introduction of an auxiliary tapping hole and spout, as a precaution against accidents. The most important change in the other parts of the plant was the introduction of basic converters and reverberatory furnaces. These are described fully by Mr. D. H. Browne in a paper entitled "Recent Improvements and Additions to the Smelting Plant of the Canadian Copper Company," read before the Canadian Mining Institute. Excerpts from this paper are here given.

These basic converters are 37 feet 2 inches long by 10 inches in diameter, outside measurement. They turn on four tread rings 12 feet in diameter. The stack or opening in the roof for the escape of gas is in the centre of the cylinder instead of at the end, as in the Garfield plant. There are 44 tuyeres, 1¼ inches in diameter and 7 inches apart. There are no tuyeres directly under the stack. The length inside the lining is 33 feet 3 inches. The bottom is 2 feet thick, the back or tuyere wall is 18 inches and the front 15 inches thick. The roof is a 12-inch arch. The brick directly around the tuyeres is 24 inches thick.

These converters have two openings or spouts in the front wall opposite to but above the tuyere line. The shell is turned down to pour slag and matte from these openings or turned back to blow by means of two wire ropes which surround the shell on either side of the central stack. These ropes are fastened to a hydraulic piston working in a horizontal cylinder, having a stroke of nine feet.

As the usual hydraulic equipment would not be suitable to the climate of Northern Ontario, oil is used instead of water, since oil remains fluid at low temperatures.

This is moved in the cylinders by air pressure. Two tanks are provided, one for regular use, one for emergency. These tanks are of ¾-inch steel, 4 feet in diameter by 15 feet high. Into these tanks a small amount of oil is pumped, and the space above the oil is filled with air at 75 lbs. pressure. An electrically driven pressure pump now forces more oil into the cylinders, compressing the air to 300 lbs. pressure. At this pressure the pump automatically stops. When it is desired to turn down the converter a valve is opened on the converter platform, allowing the oil to pass to one side or the other of the hydraulic cylinder, moving the piston and so by means of the rope tackle turning the converter as desired. In this operation the air in the tank above the oil expands and loses pressure. When the pressure in the tank falls to 200 lbs. the oil pump starts automatically pumping oil into the tank till the pressure rises to 300 lbs.

As the entire equipment of the plant is electrically driven it is manifest that if for any reason the power went off the line the converter blower would stop blowing air into the tuyeres. The matte would then run back through the tuyeres, as the mechanism for turning the converter down, being also electrically driven, would be useless. To avoid this a spare tank always contains oil under 300 lbs. pressure. This spare tank is connected to the hydraulic cylinder by a valve which is held closed by a solenoid brake. The fly wheel of the converter blower is of sufficient size to keep the engine turning over and delivering air for perhaps 15 to 20 seconds after the power goes off. The solenoid brake is actuated by the electric power, and the moment the power goes off the solenoid brake drops, opening the valve, and admitting oil to the proper side of the cylinder to turn the converter down.

It sometimes happens that a thunderstorm twenty-five miles from Copper Cliff will cut off the current on the power line. The safety device above described, being absolutely automatic and entirely separate from the regularly used turning device, has proved quite satisfactory.

The basic converter takes an initial charge of about 60 tons of furnace matte. About ten per cent. of quartz rock, previously dried, is dumped into the converter, and the blast is turned on. Blowing is done entirely by the clock. The charge is blown from one-half to three-quarters of an hour and is then turned down to skim slag. While the slag is being poured off, five or six tons of furnace matte is poured into the converter. After the slag is poured about three tons of quartz or siliceous ore and quartz are added and the shell is blown for another fixed time. The length of the blow, the amount of slag removed, the weight of matte added after each skim and the per cent. of flux required, are all factors of the grade of matte and have to be determined by experience.

The blowing and the addition of matte are kept up until there remains in the converter seventy or eighty tons of finished product. This may require from 300 to 400 tons of furnace matte and from 30 to 50 hours blowing time, depending on the matte grade. The finished matte is then cast into moulds, and the cycle of operations re-commences.

The basic converter has several advantages over the acid converter. The units are very much larger. This simplifies the problem of dealing with large quantities of matte. There is practically no material slopped out of the converter during the blow, and hence less furnace matte is required to produce a ton of bessemer matte. The slag made is lower in silica, which means economy of flux. The converter slag contains less copper-nickel than the acid converter slag; but since all the converter slag has to be re-treated, this of itself is not material. As a whole the operation of converting has been much simplified by the change.

In the year 1911 The Canadian Copper Company commenced the erection of two large reverberatory furnaces. The first of these was blown in at the end of December, 1911.

The furnaces built at Copper Cliff are 112 feet by 19 feet hearth area. The side walls are 27 inches thick. The roof is 20 inches for the first 35 feet near the coal burners and 15 inches thick for the rest of the way. The extreme height inside is 6 feet. The bottom is an inverted arch of magnesite brick, with a spring of 12 inches. The spring of the roof arch is 19 inches, one inch rise to the foot.

The foundation of these furnaces was made by building a trestle about 14 feet high, and pouring furnace slag from this, to build up within the outer walls a solid block of slag ten feet above the yard level. On this foundation the side walls of the reverberatory furnaces were built. Slag was poured inside these walls to form a hearth or furnace bottom about two feet thick. By this a solid mass of slag about 12 feet thick was formed under the furnace. Between the furnaces openings were formed by concrete retaining walls, so as to leave tunnels entering the slag foundation at the yard level and at either side of each furnace. Through these tunnels the melted converter slag is brought to the reverberatory and matte is taken back.

The hearth of the furnace is formed by levelling up the poured slag bottom with concrete so as to provide an inverted arch of the same curve as the magnesite brick lining. On this form one layer of fire brick was laid flat, 2½ inches thick. Over this 9 inch magnesite brick was laid. This brick hearth was laid in a mixture of ground magnesite and linseed oil. Expansion strips of wood were placed between every six courses. The expansion allowed is ¼-inch to the foot.

The side wall is of silica brick 18 inches thick. On this the roof rests. Inside this wall a flash wall of magnesite 9 inches thick is built. This does not support, but is brought close up to the roof. The tap hole is so placed as to retain 12 inches of matte in the hearth, so that the bottom is always protected by a pool of matte.

Slag is removed, not at the front of the furnace as is usually the case, but at either side of the furnace, where the side walls commence to narrow in, about 11 feet from the front of the furnace. The space at the front usually occupied by the slag door slopes up gradually from the hearth to form a straight outlet for the products of combustion. The area of the throat is about 27 square feet. The gases meet no obstacles whatever, but pass straight into a cross flue 6 feet by 9 feet, which is covered by cramps. This flue is 70 feet long, and leads to the main or dust chamber flue. The main flue is 15 feet by 19 feet by 177 feet, and connects with the stack. The stack is 17 feet 2 inches diameter at the bottom, 15 feet 4 inches diameter at the top, and 200 feet high.

At the fire end of the furnace two sets of charging bins are provided. These are used to drop flue dust, ore fines and other pulverized material into the furnaces. Each bin has five hoppers, discharging by slide gates through the roof.

The most interesting part about the reverberatory is the method of firing. Coal is dropped from the trestle into storage bins. Out of these bins it passes through a coal cracker on to a conveyor belt. This coal ½ inch in size, and under, is carried by this conveyor belt to the coal grinding room and dropped into a bin. From this bin it is fed by a screw conveyor to a Ruggles Coles dryer. The dry coal is elevated into bins, from which it drops into two Raymond impact pulverizers. This grinds the coal to the finest powder, most of it passing a 200 mesh screen. This pulverized coal is sucked up by a fan into a separator on top of this building, and passed by screw conveyors into the reverberatory building, and dropped into bins at the end of the furnaces. From these bins it is taken by five variable speed screw conveyors 4 inches in diameter. These deliver the coal into five burners, dropping it in front of nozzles which carry air from a fan. The air blast sends the coal into the furnace in the form of a cloud or spray of dust, which burns just like fuel oil. Each burner can be run independently, and the amount of coal or air can be varied at will.

The slag from the converter building is brought to the reverberatory furnace in ten-ton pots by a locomotive, which enters the tunnels between the furnaces. Through openings in the roofs of these tunnels the reverberatory cranes pick up the slag pots, and pour the slag through an opening in the roof into the furnace. The slag skull being left in the pot, the pot is set back on its truck in the tunnel, and reverberatory matte is tapped into it. This reverberatory matte is taken back by the locomotive to the converter building and charged into the basic converters.

Cobalt Silver Refining Plant

The Copper Cliff plant treated about 300 tons of cobalt silver ore per month during the year, largely high-grade. There has been but little change in the process. Refined silver, arsenic and cobalt-nickel hydrates are shipped.

The freight rate from Cobalt to Copper Cliff on ore having a value of:

1. Under $50.00 per ton, is $4.00 per ton.
2. $50.00 and under $100.00 per ton, is $5.20 per ton.
3. $100.00 and under $500.00 per ton, is $6.00 per ton.
4. $500.00 and over per ton, is $7.00 per ton.

The schedule of payment by the company for the ores f.o.b. Copper Cliff is as follows:

84	per cent. of	silver per	ton of ore when	same assays	200 to 500	oz. silver,
85	"	"	"	"	500 to 600	"
87	"	"	"	"	600 to 800	"
90	"	"	"	"	800 to 1,000	"

92	per cent. of	silver per	ton of ore when	same assays	1,000 to 1,300	oz. silver,
93	"	"	"	"	1,300 to 1,600	"
93½	"	"	"	"	1,600 to 2,000	"
94½	"	"	"	"	2,000 to 2,500	"
95	"	"	"	"	2,500 to 3,000	"
95½	"	"	"	"	3,000 to 4,000	"
96	"	"	"	"	4,000 to 5,000	"
96½	"	"	"	"	5,000 and over.	

Payment is made for 70 per cent. of the net proceeds according to the New York official quotation 30 days after sampling, and the balance in 60 days according to the same official quotation on that date.

Mond Nickel Company

This company shipped ore during the year from their Victoria and Garson mines to the smelter at Victoria Mines.

Development work was begun on the Frood Extension, a property adjoining the Frood mine of the Canadian Copper Company. Good progress has been made in the erection of the company's new smelter at Coniston, near Rumford Junction, 7 miles east of Sudbury. The railway tracks for use around the plant have been completed, as also the foundations for the main buildings of the plant.

The officers of the company are Mr. C. V. Corless, manager, and Mr. O. Hall, mine superintendent.

Victoria Mines

The main shaft at the mine has been sunk 200 feet since last Report and is now 1,560 feet in depth, by far the deepest workings in the Province. Work was carried on during the year on the fifth, eighth, ninth, tenth, eleventh, twelfth and thirteenth levels. On the fifth level an exploratory drift has been run east about 800 feet to an ore body that had been worked to a depth of 200 feet. The chief workings consist of two ore bodies 150 to 200 feet apart, dipping to the east. At the twelfth level the west body is 330 feet from the shaft and the east 630 feet. On account of the distance of the ore bodies from the shaft, levels are now run at intervals of 200 feet and the ore is stoped out in 100-foot sections. Stoping is being done on all the levels from the eighth to the twelfth.

Garson Mine

This mine now produces the bulk of the tonnage treated by the company. Work is being carried on on the first, second, third, fourth and sixth levels, and stoping done on all these levels. The ore bodies are irregular in outline and dip to the east, so that the workings extend over an area of 720 feet by 840 feet. As some of the stopes are narrow and others wide, no uniform system of stoping has been adopted. Some of the stopes are mined by back-stoping and filling; others by underhand stoping. A body of quartz was discovered underground and is being mined and shipped to the smelter. All the ore is at present hoisted in single-deck cages. Preparations are now under way for the introduction of skips having a capacity of four to five tons. This will necessitate a change in the head-frame and ore-sorting house.

An additional compressor has recently been installed. The power plant now consists of two Rand and one Sullivan 14-drill compressors, electrically driven. A transmission line from Victoria Mines to Garson is being erected.

Mr. A. Sharp is mine superintendent, employing 300 men.

Frood Extension Mine

The Mond Nickel Company purchased and began work on the property adjoining the Frood mine of the Canadian Copper Company. The ore body was first located by diamond drill. A 4-compartment shaft is at present being sunk and has now reached a depth of 150 feet. It is proposed to sink this shaft to a depth of 1,000 feet before any other work is done.

A power plant has been erected, consisting of two 100-h.p. boilers, 8-drill compressor, and double drum hoist.

Smelter

Operations were carried on at the smelter at Victoria Mines in a manner similar to former years, and no important changes were made. This smelter will be abandoned as soon as the new one at Coniston, near Rumford Junction, is completed.

Dominion Nickel Copper Company

This company have continued development work throughout the year. A main adit was driven from a point near the rock house into the hill, a distance of 440 feet. Drifts and cross-cuts were run from the adit, in all a distance of 1,200 feet. A 50-foot raise was driven from the end of the adit.

The surface plant remains the same. Electric power is obtained from the Wahnapitae Power Company.

Gold

Long Lake

Owing to lack of power the Canadian Exploration Company, owners of the Long Lake gold mine, did not carry on very extensive operations during the year. The mill, however, was enlarged by the addition of 10-stamps, and changes made in connection with the cyanide treatment of the ore.

The main shaft has been sunk to the 180-foot level and 60 feet of drifting done on this level.

A transmission line has been erected from the mine to the Wahnapitae Power Company's plant on the Wahnapitae river.

Mr. R. W. Brigstocke is manager and Geo. E. Cole, superintendent.

Iron

Moose Mountain

Owing to the decrease in the demand for iron ore, shipments from this mine ceased early in the spring of 1911, and no ore has since been shipped. As a result, no work was done in the mine, except development work. Work was, however, begun on a large concentrating plant for handling the low-grade iron ore. The Gröndal process for the magnetic concentration of the ore is to be used. It is expected that the plant will be ready for operation in June of this year.

Michipicoten Area

The only work of any magnitude done in this area during 1911 was by the Lake Superior Power Company in the development of their iron properties. The Algoma Central Railway Company have practically completed their line from Sault Ste. Marie to the main line of the Canadian Pacific at Hobon, with branches to the Helen and Magpie mines.

Helen Iron Mine

The production of hematite from this mine was in excess of the previous year, and, in addition, development work has been carried far enough ahead to assure steady shipments during the present season of navigation. No. 2 shaft has been sunk to the ninth level, 650 feet from the surface. The levels are run approximately 70 feet apart. The greater part of the production during 1911 came from the sixth and seventh levels. No. 2 shaft is a 2-compartment one to the sixth level, and a 4-compartment from the sixth to the bottom. A new method of mining has been adopted on the seventh level. This method follows somewhat the caving system used at some of the iron mines in Michigan. The main drift is driven to the extreme limit of the ore body. Sub-levels are then run at intervals of about 20 feet. These are blocked out by drifts into rectangles 20 feet by 40 feet or smaller. Raises are carried up at intervals of 20 to 30 feet, and ore is drawn therefrom. Above the seventh level, three of these sub-levels have been begun, and will be carried forward to block out ore for the summer shipments. The ore taken from development work during the winter has been stockpiled. On the eighth level, the station has been cut, and the main drift driven 350 feet, and No. 2 drift 150 feet. On the ninth level, the station has been cut. A system of washing the ore was installed during the year to reduce the sulphur content. Exploratory work has been carried on under Boyer lake from the fifth level of the mine.

Mr. R. W. Seelye is manager and Mr. A. Hasselbring general superintendent for the company in the Michipicoten area. Mr. A. A. Mackay is mine superintendent, employing 250 men.

Magpie Mine

The railway branch to the Magpie was completed in July, 1911, and development work at the mine and the erection of plant were thus facilitated. The main shaft has been sunk to a depth of 205 feet, with levels at 125 feet and 205 feet. On the 125-foot level, a cross-cut, 125 feet in length, has been driven from the shaft to the vein and across it. Drifts have been run on the vein southeast 400 feet and northwest 450 feet, and cross-cuts driven about every 100 feet across the vein. A raise has been put through to the surface from the southeast drift 300 feet from the shaft. On the 205-foot level, a cross-cut has been driven to the vein and drifting started.

The erection of a roasting furnace for the ore is in progress, and it is expected that one unit will be completed during the summer. An electrically driven compressor and hoist will be installed, and a steel head-frame erected. Cottages, sleeping and dining-rooms for the men, and a hospital have been built.

Blast Furnace, Sault Ste Marie

The Algoma Steel Company have in blast three furnaces, having a total output of about 800 tons of pig iron for 24 hours. The No. 3 furnace was blown in during 1911. Nos. 1 and 2 furnaces are smaller than No. 3, and are less modern in type. The total production of Helen mine ore is used in these furnaces, together with American ore. Coke is produced at the company's coke ovens, situated near the blast furnaces. The power plants for the production of power for the blast furnaces, open-hearth furnaces, rail mill and merchant mill, are all operated by blast-furnace gas. The new power plant consists of eight gas engines, four of which are directly connected with blowing engines, and four with generators, developing 1,500 kilowatts each. There are also a number of motor-generator sets for transforming the alternating current into direct current for use on the trolley lines, etc. A gas washing-house has been erected.

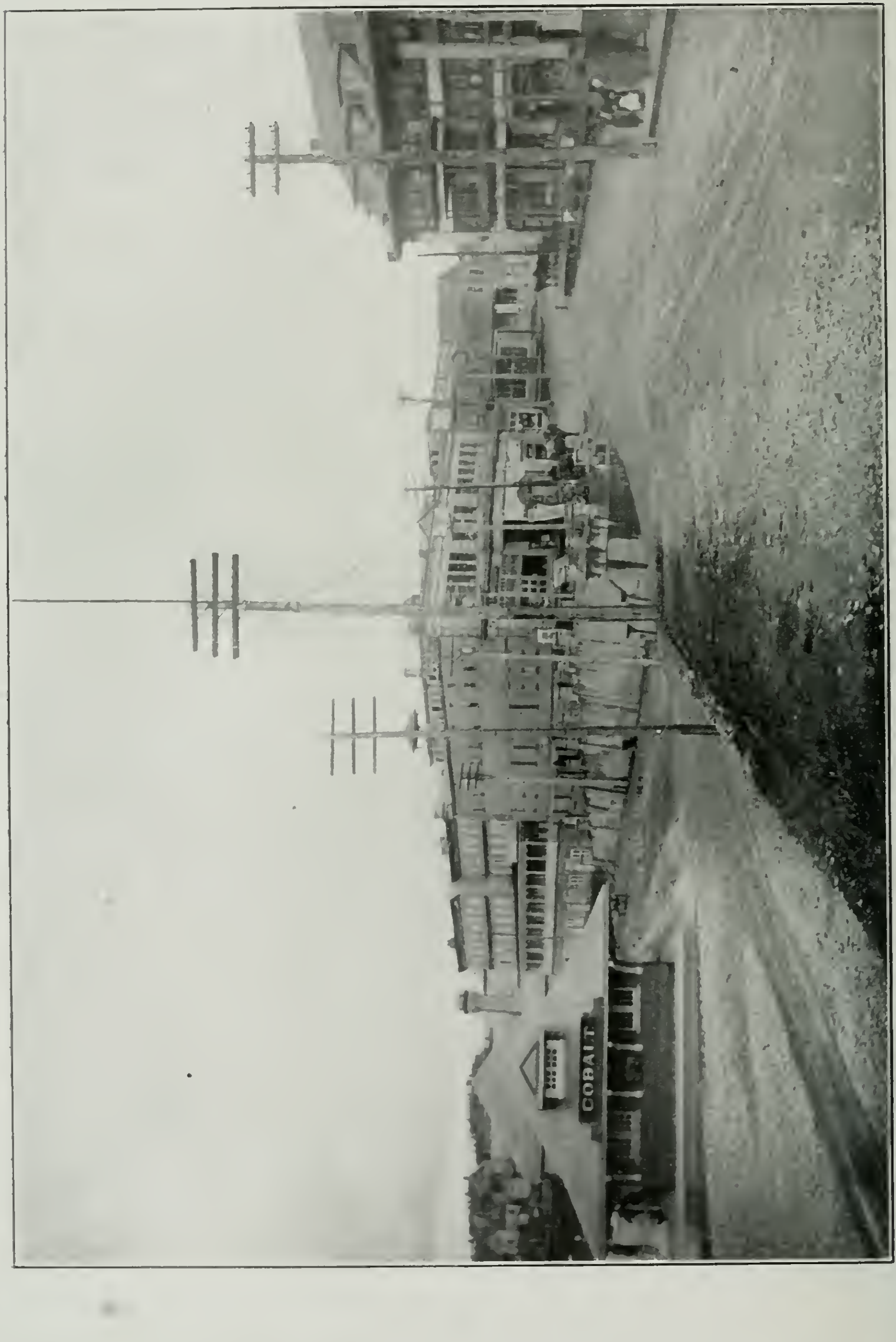
III.—TEMISKAMING

Cobalt and Vicinity

Cobalt's production of silver in 1911 again exceeded that of any previous year, the total yield being 31,507,880 ounces, compared with 30,651,417 ounces in 1910. The production came largely from the same mines as in 1910. A number of the small producing mines and prospects were not in operation during the year, but the increased price in silver for 1912 has stimulated a number of these to resume work. About the same number of men were employed during 1911, as in the preceding year, and the rate of wages remained the same.

Power

The power situation was satisfactory, with the exception of the months of February, March and April, 1911, when, owing to low water in the rivers, the power plants were unable to furnish the required amount of power. As a result, those mines with steam plants put them in commission, and the other mines operated at a reduced capacity. The shortage reduced the production of ore for those months, and consequently the year's



Central square, Cobalt.

output. Two companies now furnish the electric and air power to the mines of the camp. These are the British Canadian Power Company, with power plant on the Metabitchewan river, and the Northern Ontario Light and Power Company, with plants on the Montreal river at Hound and Ragged chutes. The latter company is a consolidation of the Cobalt Power Company and the Cobalt Hydraulic Power Company.

Concentration

Cobalt now has the largest concentrating mill, not only in Ontario, but in Canada, and also the largest number of mills in any single mining area in the Dominion. New mills were erected during 1911, and old ones enlarged. The following table gives a list of the mills, and the normal capacity of same, that have been erected in the Cobalt camp:—

Mill.	Capacity per day.	No. of stamps.	Remarks.
1. Beaver	60 tons.	Crushing by rolls.	
2. Buffalo	145 "	"	
3. Cobalt Central	75 "	"	Idle in 1911.
4. Cobalt Lake	65 "	20	
5. Colonial	25 "	10	
6. Coniagas	180 "	60	
7. Hudson Bay	60 "	20	
8. King Edward	30 "	10	Leased to City of Cobalt Mining Co
9. McKinley-Darragh-Savage.	150 "	30	
10. Nipissing	200 "	40	Not in operation in 1911.
11. Nipissing Reduction	50 "	Crushing by rolls.	Custom mill.
*12. Northern Customs	280 "	114	"
13. Nova Scotia	120 "	40	"
14. O'Brien	100 "	30	
15. Silver Cliff	75 "	Crushing by rolls.	
16. Temiskaming	115 "	40	
17. Trethewey	100 "	30	
	1,830	444 stamps.	

*_Had capacity of 180 tons per day in 1911 with 74 stamps in operation. The additional stamps were put in in 1912.

Of the above mills, the Buffalo, Nipissing, Nova Scotia, and O'Brien use cyanidation, in conjunction with concentration. The Nipissing had a small mill in operation during 1911, treating high-grade ore. The Butters process is adopted in this mill, and consists of amalgamation and cyanidation.

In addition to these mills, the Cobalt Provincial, Crown Reserve, Kerr Lake, La Rose, and Savage mines have small plants for coarse concentration. These plants consist of picking belts, or tables, and jigs.

Smelting

Ontario smelters treated about 60 per cent. of the total number of ounces shipped from the Cobalt camp during 1911. These smelters are as follows:—

1. Canada Refining & Smelting Company, Orillia.
2. Canadian Copper Company, Copper Cliff.
3. Coniagas Reduction Company, Thorold.
4. Deloro Mining & Reduction Company, Deloro.

The foreign companies buying cobalt-silver ores were:—

1. American Smelting & Refining Company, New York.
2. Balbach Smelting & Refining Company, Newark, N.J.
3. Pennsylvania Smelting Company, Pittsburg, Pa.
4. United States Metals Refining Company, New York.
5. Beer, Sondheimer & Company, Frankfort-on-Main, Germany.
6. Government of Saxony, Saxony, Germany.

The freight rates and schedules of prices paid for ores by the smelters in Ontario are given on other pages of this Report.

Accidents

During 1911, there were nine fatal accidents in the Cobalt camp, causing the death of nine men. This shows a marked decrease, compared with 1910, when 20 men lost their lives while working in or about the Cobalt mines.

There were three men killed in the Gowganda area in 1911, and none in the Montreal river or South Lorrain areas. In these areas, in 1910, there were four men killed.

On June 1st, 1911, Mr. T. F. Sutherland was appointed Assistant Inspector of Mines. Mr. Sutherland's headquarters are at Cobalt, and he inspects the mines, not only of the Cobalt camp, but the outlying silver camps, and Porcupine. He also makes trips of inspection to mines in other parts of the Province, when necessary.

Other Silver Camps

Considerable work was done during the year at South Lorrain, Montreal River and Gowganda.

In South Lorrain, the principal shipper was the Wettlaufer mine, while a shipment was made from both the Keeley and the Bellellen. A 10-stamp mill has been erected at the Wettlauffer mine. On a number of other properties, development work was carried on throughout the year.

Since the Government has announced that a branch line will be built from the T. & N.O. railway at Charlton to Elk lake during 1912, there has been a revival of mining activity along the Montreal river. During 1911, there was a small shipment of ore from the Hitchcock property, but very little development work was done in the area.

In the Gowganda area, the Millerett and the Miller Lake:—O'Brien have shipped steadily, and a ton of ore was sent out from the Powerful mine. A 10-stamp mill was built and put in operation at the Millerett. The building of the Elk Lake branch will also assist this area.

Following is a brief description of the mines and more important prospects of Cobalt, South Lorrain, Montreal river and Gowganda that were in operation during 1911:—

Cobalt Silver Mines

Badger

Work during the year was confined chiefly to the Nos. 4 and 5 shafts. From the drift on the 75-foot level, 120 feet south-west of the shaft, a winze was sunk a depth of 100 feet, and 320 feet of drifting done at this level. The No. 5 shaft has been sunk to a depth of 344 feet, and at this depth a drift was run south-west 300 feet and a cross-cut driven from the end of this drift south, 140 feet to the south boundary of the property.

Bailey

The Bailey Cobalt Mines, Limited, have been working on the south-west quarter of the north half of lot 4 in the fourth concession of Coleman. Most of the work during the year has been done on the fourth level, which is at a depth of 232 feet. From the shaft, a drift has been run west 315 feet, where a cross-cut driven from a raise from this drift connects with a winze from the Cobalt Central workings.

A cross-cut has been driven from the main drift south-west 315 feet. This cross-cut intersects No. 4 vein, on which a drift has been run north-west 135 feet and south-east 90 feet. Three raises have been started on this vein.

The plant consists of a motor-driven compressor, hoist, and a 25-h.p. boiler for heating purposes, electric power being obtained from one of the local power companies.

Mr. Floyd Weed is manager.

Beaver

The Beaver mine situated on the north half of the north-west quarter of the north half of lot 1 in the third concession of Coleman is owned and operated by the Beaver Consolidated Mines, Limited, with an authorized capital of $2,000,000, the shares having a par value of $1.00. Mr. Frank L. Culver is president and general manager, Mr. H. E. Tremain, secretary-treasurer, and Mr. A. J. Hewitt, mine superintendent.

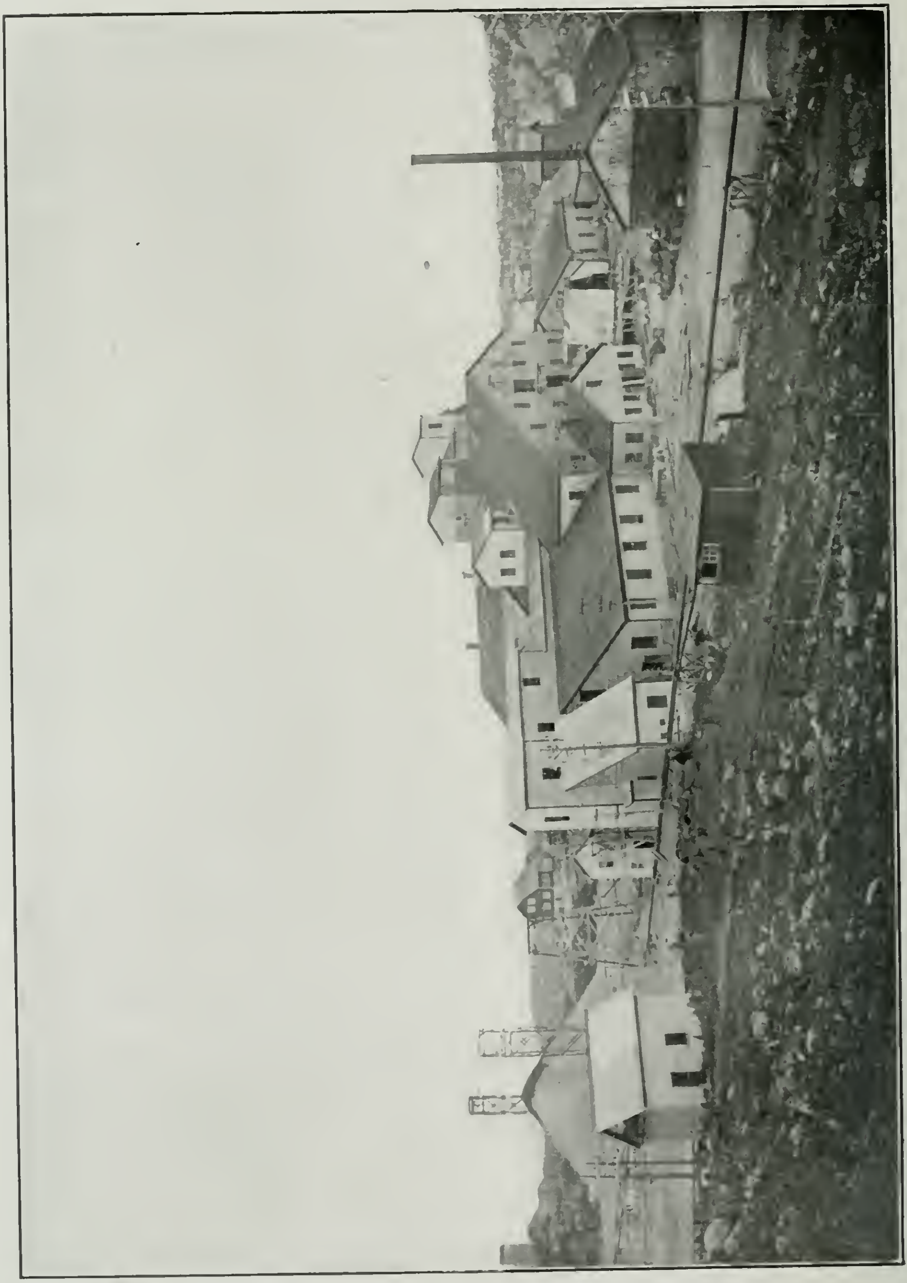
The plant consists of two 80-h.p. boilers, 12-drill compressor, hoist and concentrating mill. The mill was erected in 1911 and 1912, and has a capacity of about 60 tons per day. The crushing is done by crushers, rolls and pebble mills, and the method of concentration follows closely the practice adopted in the other mills of the camp. Electric power for driving the mill machinery and compressed air for the mine is obtained from one of the local power companies.

The main shaft has been sunk to a depth of 548 feet, with levels as follows: First level at 75 feet, second level at 200 feet, third at 250 feet, fourth at 300 feet, fifth at 350 feet, sixth at 400 feet, seventh at 460 feet, eighth at 530 feet. The same plan of development work has been followed from the second to the sixth levels. As the main shaft is near the southern line of the property, practically all the underground work is to the north of it. The drifts on the vein on the various levels are started from the main cross-cut about 75 feet east of the shaft, and run in a northerly direction for a distance of 450 feet. Stopes have been opened up on the several levels, and the levels connected by means of a winze, 210 feet north of the shaft. On the seventh level, the main drift north has been run 200 feet, and on the eighth level, the shaft station has been cut. The manager reports that 175 feet of sinking, 390 feet of raising, 807 feet of cross-cutting, 2,142 feet of drifting, and 4,214 cubic yards of stoping were done during the year.

Buffalo

This mine, situated on the townsite of Cobalt, is owned and operated by the Buffalo Mines, Limited, which has an authorized capital of $1,000,000, the shares having a par value of $1.00. Mr. Chas. L. Denison, of New York, is president, Mr. Geo. C. Miller, secretary-treasurer, and Mr. Tom R. Jones, mine superintendent. The company paid $1,377,000 in dividends to December 31st, 1911.

The plant consists of a 500-h.p. boiler, a 12-drill compressor, hoists at Nos. 4, 6, and 12 shafts, a concentrator having a daily capacity of 145 tons, and a cyanide plant. Compressed air and electric power are obtained from the Northern Ontario Light and Power Company. The ore bodies opened up are confined to two main systems of veins, about 550 feet apart, each having an easterly and westerly strike. On the northerly system, No. 5 and No. 6 shafts have been sunk to the second level, and the vein opened up on both levels from the easterly boundary of the property west to No. 6 shaft, a distance of 560 feet. The southerly vein series has been opened up on four levels at depths of 80 feet, 150 feet, 225 feet and 300 feet. A cross-cut has been driven from No. 4 shaft to No. 6 shaft on the first and third levels, and all ore from the southerly veins trammed to No. 6 shaft, where it is hoisted to the mill. The southerly vein system has been opened up on the first three levels for a length of about 700 feet. The No. 12 shaft is sunk to the fourth level, and the vein on the level developed for 300 feet. Ore has been blocked out in all these stopes and partially broken down. The total underground work done at the mine to April 30th, 1912, is 1,019 feet of sinking, 10,185 feet of drifting, and 47,215 cubic yards of stoping.



Concentrating mill, Buffalo silver mine, Cobalt.

The same system of concentration is in vogue in the mill as has been outlined in former reports. Some additions have been made to the mill by putting in a Dorr thickener and additional slime tables. The cyanide plant is fully equipped with agitating tanks and precipitating boxes, and the tailings from the slime tables are re-treated here. From 45 tons of mill rock, about one ton of concentrates is obtained.

Casey Cobalt

This property, situated on the southeast quarter of the south half of lot 5, in the first concession of Casey, about 10 miles northeast of the town of New Liskeard, is controlled by the Casey Cobalt Silver Mining Company, Limited, with an authorized capital of $100,000.

The power plant consists of two 40-h.p. boilers, a straight line compressor and hoist. A larger power plant is now being installed.

The shaft has been sunk on the vein, which dips to the southeast at an angle of 70 degrees, to the depth of 260 feet, with levels at 33 feet, 100 feet, 160 feet, 210 feet and 260 feet. Work done during the year was confined mainly to the 210-foot and 260-foot levels. On the 210-foot level, drifts were run northeast 60 feet, and southwest 100 feet. Just north of the shaft is a cross-cut 190 feet in length, and from the drift southeast of the shaft a cross-cut west 140 feet, where a new vein was encountered. On this vein 185 feet of drifting has been done, and a new shaft started. On the 260-foot level, a cross-cut was driven west 100 feet, and 225 feet of drifting done on the vein. A raise was also put through to the 210-foot level. Several car-loads of low-grade ore were shipped to the Northern Customs Concentrator at Cobalt for treatment.

Chambers-Ferland

This property, situated to the north and west of the town of Cobalt, comprises 124 acres, practically surrounding the La Rose and La Rose Extension, and is owned and operated by the Chambers-Ferland Mining Company, Limited, with an authorized capital of $2,500,000, the shares having a par value of $1.00. Mr. A. Ferland is president, Mr. Alex. Fasken, Toronto, secretary-treasurer, and Mr. B. W. Yorick, manager.

Mining work during the year has been confined to No. 1 shaft, which was sunk on the continuation of No. 10 vein of the La Rose. The shaft is 160 feet deep, with levels at 42 feet, 93 feet and 150 feet. The length of the vein lying between the La Rose and O'Brien mines is 180 feet. Some work has been done on two other veins encountered underground.

City of Cobalt

This property consists of about 40 acres of the townsite of Cobalt, of which the City of Cobalt Mining Company, Limited, have a 99-year lease from the Temiskaming and Northern Ontario Railway Commission, and pay 25 per cent. royalty to the latter. Mr. R. T. Shillington is president, and Mr. J. A. McVichie mine superintendent. The authorized capital is $1,500,000, with shares of a par value of $1.00. The company have paid $139,312.42 in dividends.

The main shaft is 340 feet in depth, with levels at 65 feet, 137 feet, 200 feet, 265 feet and 330 feet. The work during the year has been confined to the lower levels, where a number of exploratory drifts and cross-cuts have been run. One drift on the 200-foot level has been run northerly to the Coniagas boundary, a distance of 500 feet. On the 265-foot level about 1,800 feet of drifting and cross-cutting has been done, and on the 330-foot level 700 feet.

The company have leased the King Edward mill and are treating their low-grade ore there.

Cobalt Lake

The bed of Cobalt lake and 33 feet of the road allowance on the east shore of the lake were purchased from the Ontario Government in December, 1906, and the Cobalt Lake Mining Company, incorporated, with an authorized capital of $5,000,000,000, with shares of a par value of $1.00, to take over and operate the property. Sir Henry Pellatt is president, and Mr. M. B. R. Gordon manager.

Mining work was carried on during the year through No. 4 and No. 6 shafts. From the 154-foot level of No. 4 shaft a drift was started to connect with a drift from the No. 6 shaft, in order to provide an auxiliary exit to both workings. Owing to loose ground encountered it was decided to abandon this drift and sink the shaft to another level. The work of sinking this shaft is now in progress.

No. 6 shaft at the south end of the lake is 143 feet deep. A drift was run west along the McKinley-Darragh's north boundary about 450 feet, where an incline winze was sunk to a depth of 110 feet. From this level a drift is being run north to No. 4 shaft to provide an auxiliary exit. Another drift has been run northwest to the Station Grounds property. Drifting has been done on the veins encountered, and stopes carried up on the veins between the fourth and second levels. A winze has been sunk from the fourth level a depth of 50 feet.

A 20-stamp mill was erected during the year near the No. 6 shaft. The ore is dumped from the bucket into a skip at the shaft mouth and hauled to the top of the mill, where it passes over a bumping table, and after being hand-sorted it goes to crushers and over trommels. The trommels separate it into three sizes, which are jigged. The tailings from the jigs are recrushed in the 20-stamp mill and the product classified. The sands are concentrated on Deister sand tables and the middlings from the tables re-ground in a tube mill. The product from the tube mill is again classified and the sands treated on Deister sand tables, and the slimes on vanners and slime tables.

Both electric and air power for mine and mill are obtained from one of the power companies.

Cobalt Provincial

The Cobalt Provincial Mining Company carried on their underground work during the year from No. 2 shaft. This shaft has been sunk a depth of 300 feet, with levels at 100 feet, 175 feet, 215 feet, and 300 feet. On the first level 150 feet of drifting was done, on the second level 280 feet, and a cross-cut driven south 300 feet, and northwest towards No. 1 shaft 600 feet. On the third level a drift was run 180 feet east and west of the shaft, and on the fourth level 150 feet of drifting and cross-cutting done. Stopes have been opened up on the vein on the different levels.

An ore-sorting plant has been erected, containing picking table, jigs, and Wilfley table.

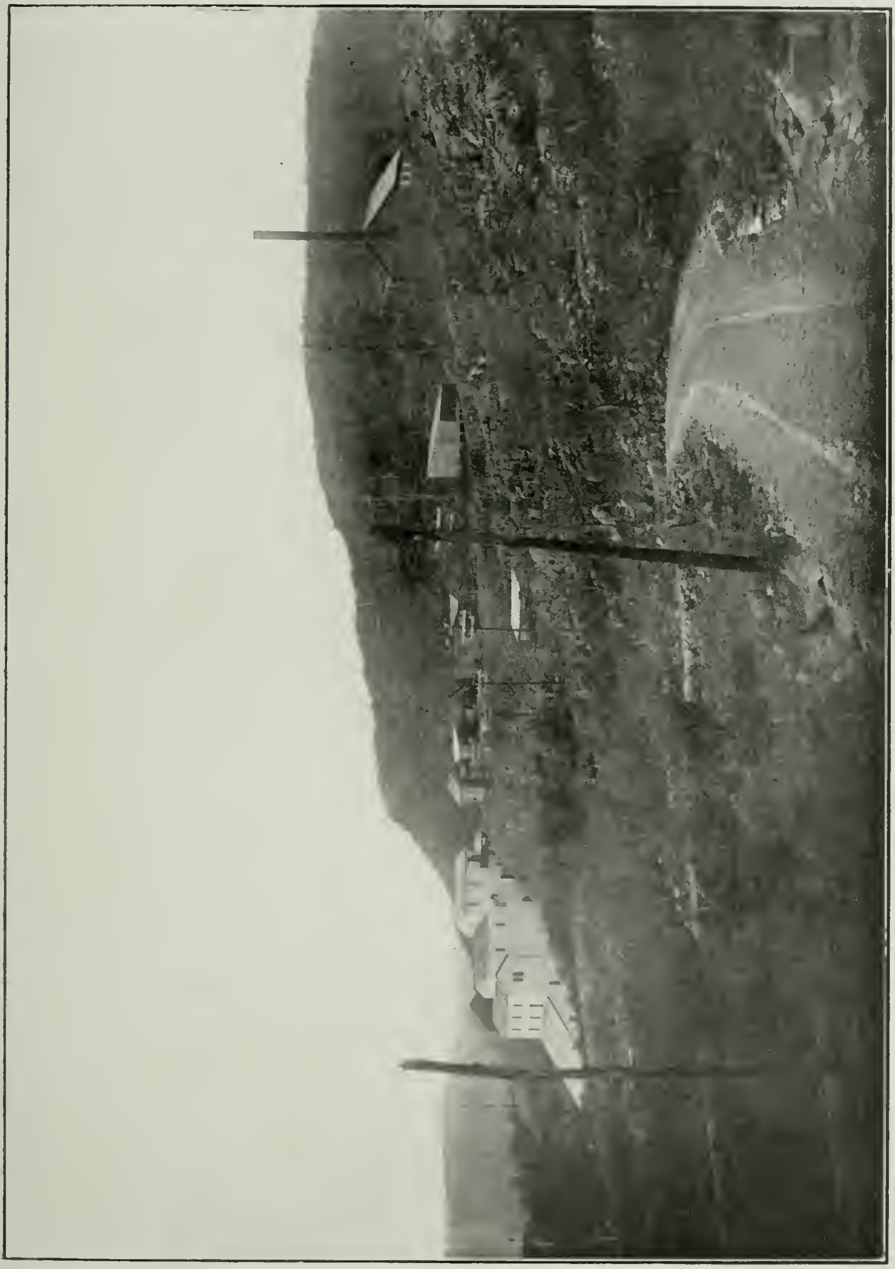
Cobalt Station Grounds

The Cobalt Station Grounds Mining Company, Limited, are operating under lease from the Temiskaming and Northern Ontario Railway Commission two parcels of ground on the townsite of Cobalt. One parcel is the mining rights extending under the right of way from just south of the Right of Way Mining Company's shaft at the north to near the McKinley-Darragh mine on the south, including the station grounds. The other parcel consists of two town lots, Nos. 388 and 389. Mr. T. A. Beament, of Ottawa, is president of the company, which has an authorized capital of 500,000 shares, of a par value of $1.00.

Very little work was done during the year. The shaft south of the station is 150 feet deep. Some drifting was done under contract by the Cobalt Lake Mining Company from their fourth level, No. 6 shaft.

Cobalt Townsite

This property is operated by the Cobalt Townsite Mining Company, Limited, with an authorized capital of $100,000, which holds a 99-year lease from the Temiskaming & Northern Ontario Railway Commission of the south 38 acres of the townsite of Cobalt. Mr. W. R. P. Parker, of Toronto, is president, and Mr. A. C. Bailey, superintendent.



The Colonial silver mine, Cobalt.

The work done during the year was confined mainly to the northern part of the property, where No. 1 shaft has been sunk a depth of 200 feet, with levels at 100 feet and 200 feet. Connection has been made on the 100-foot level with No. 2 shaft 525 feet west of No. 1. From No. 2 shaft drifts have been run south 180 feet and west 200 feet. From No. 1 shaft a main drift has been run southwest 400 feet, from which a number of other drifts and cross-cuts have been run. Raises have been put through to the surface at a number of places on the veins. On the second level drifts and cross-cuts have been driven, conforming with the development work on the first level. Some work has also been done on a vein near the south end of the lot. This work is being done from the Right of Way workings.

An ore-sorting house has been erected, and a contract made with the Northern Customs Concentrator Limited, for handling the low-grade ore. Over 12,000 tons were treated at the concentrator during 1911.

Colonial

This property is situated on the southwest quarter of the south half of lot 3 in the sixth concession of Coleman, and is operated by the Colonial Mining Company, Limited, which have an authorized capital of 100,000 shares, of a par value of $1.00. The Colonial Silver Mines, Limited, incorporated under the laws of the State of Maine, own 99,995 shares of the Colonial Mining Company. This company have an authorized capital of 1,200,000 shares, each share having a par value of $5.00. Mr. C. B. Kingsley is mine manager.

Most of the mining work has been carried on from the adit, about 100 feet from the mill. At 240 feet from the mouth of the adit a drift has been run east, and from this drift a winze sunk 140 feet. This winze is used as the main hoisting shaft, and most of the work was done during the year on the 140-foot level of the winze. On this level a drift was run west 300 feet and east 350 feet. A cross-cut was driven south from near the shaft 325 feet, and another cross-cut driven from the easterly end of the drift northwest 300 feet and southeast 125 feet. A winze was also sunk from near this easterly end of the drift a depth of 70 feet and 200 feet of drifting done at the lower level.

The 10-stamp mill has a capacity of 25 tons per day, and the general system of water concentration used throughout the camp is followed.

Coniagas

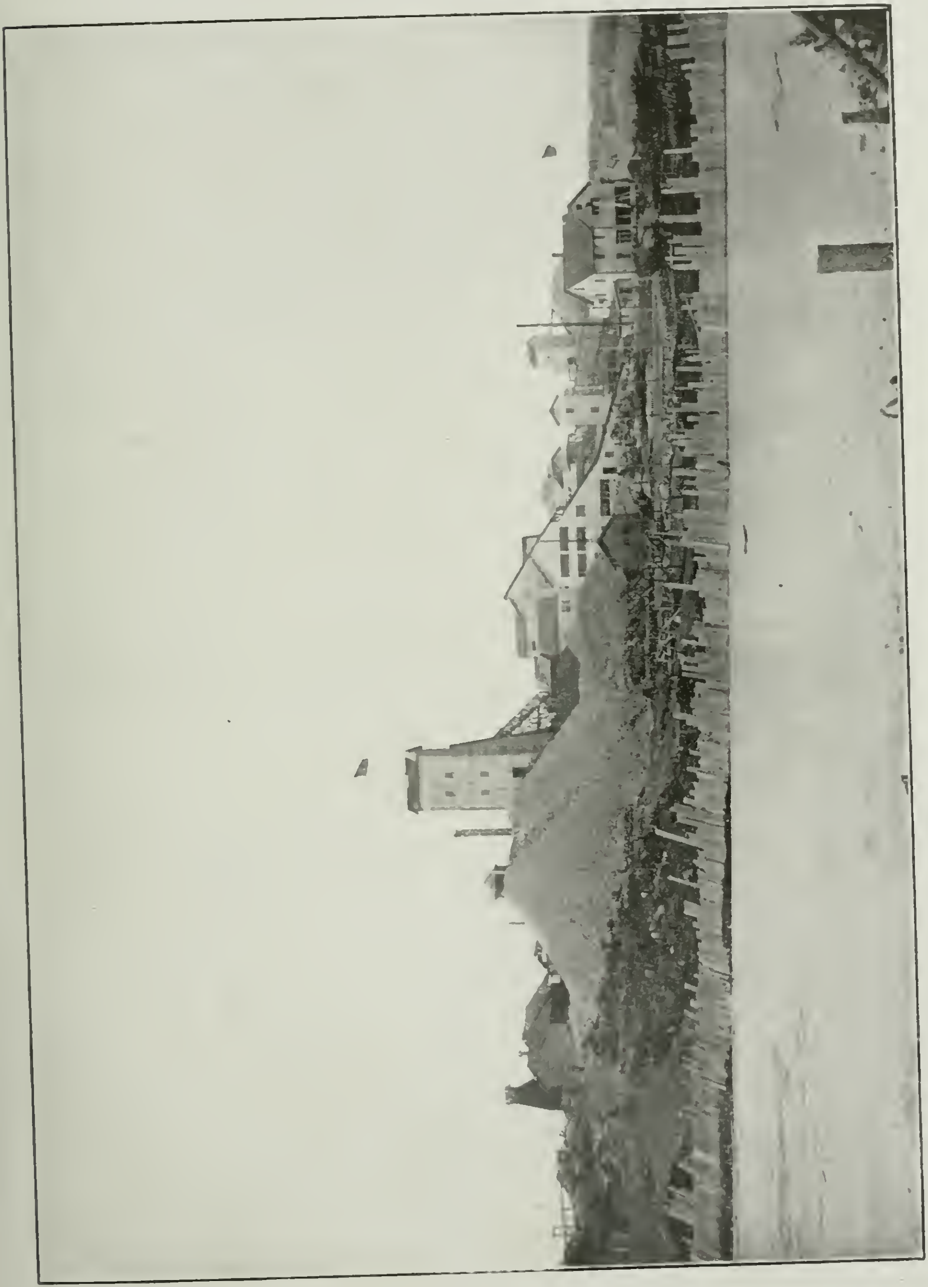
This property consists of 40 acres situated on the townsite of Cobalt, and is owned by the Coniagas Mines, Limited, which have an authorized capital of $4,000,000, with shares having a par value of $5.00. Mr. R. W. Leonard is president and general manager, and Mr. R. P. Rogers mine manager.

Development work was carried on during the year from the No. 2 shaft, which is 225 feet in depth, with levels at 75 feet, 150 feet and 225 feet. Most of the work done was on the second and third levels, where drifts have been run on the veins and the ore blocked out. Most of the veins strike east and west, though there are others branching from these main veins. One of the main veins is southeast by northwest, and a drift has been run on this to a point 400 feet south of the main shaft. No underground work has as yet been done on the southerly portion of the lot. The manager reports that during 1911 the underground work done consisted of 71 feet of sinking, 3,335 feet of drifting, 811 feet of cross-cutting, 20 feet of winzes, 184 feet of raises, and 40,304 tons of ore stoped.

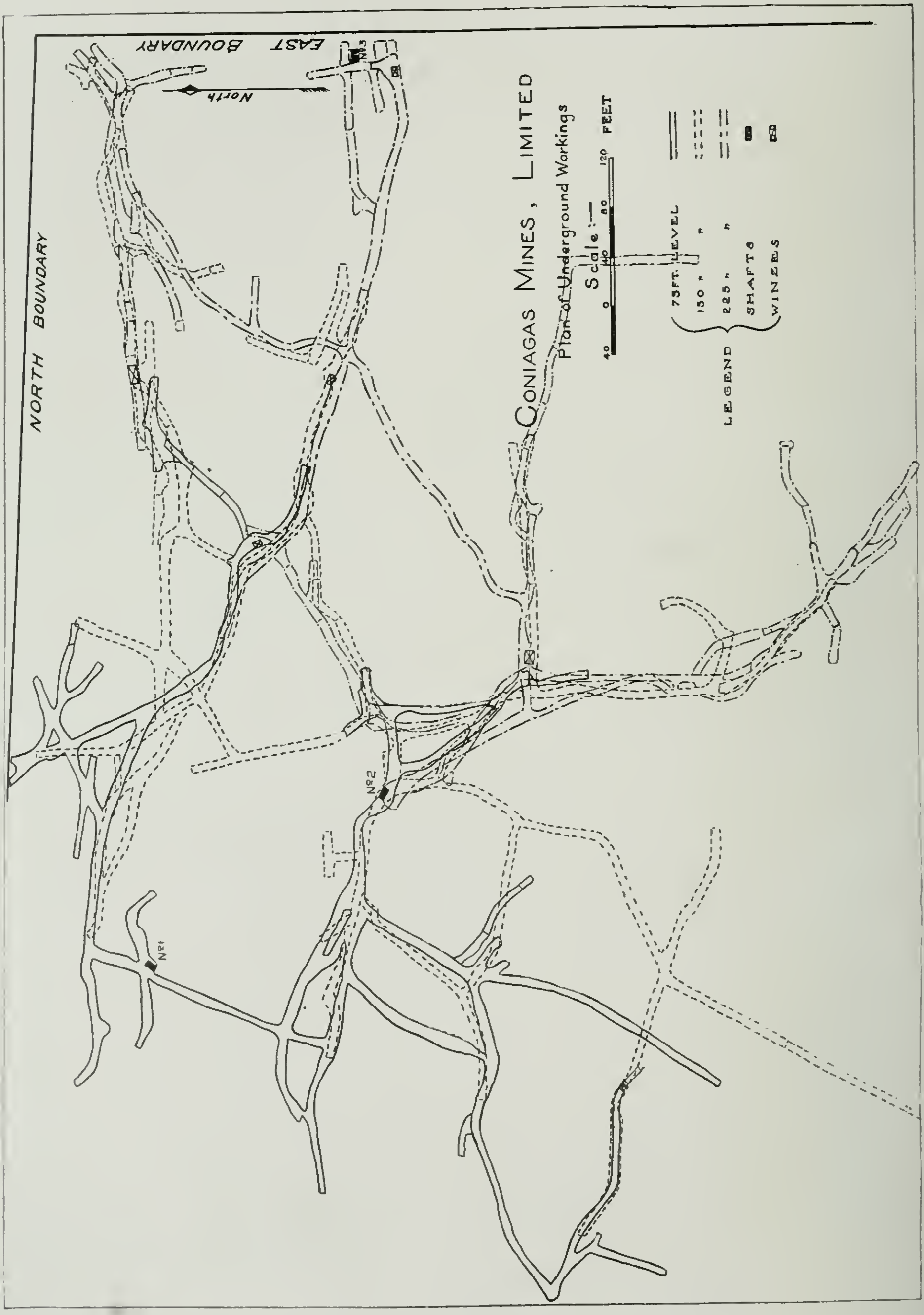
The accompanying plan shows the underground development work to December 31st, 1911.

An average of 180 tons per day is now being treated in the 60-stamp concentrating mill, which is the second largest mill in the camp. The system of concentration is as formerly described.

Mr. F. D. Reid is mill superintendent.



Coniagas silver mine Cobalt.


Coniagas Mines, Limited
Plan of Underground Workings
Scale:—
40 0 40 80 120 FEET
LEGEND
75 FT. LEVEL
150 " "
225 " "
SHAFTS
WINZES
NORTH BOUNDARY
EAST BOUNDARY
North
No 1
No 2
No 3

Crown Reserve

The bed of Kerr lake, with the exception of mining claims J.B. 9, 10 and 11, in all 23 acres, was acquired by the Crown Reserve Mining Company, Limited, from the Ontario Government in December, 1906. The Company have an authorized capital of 2,000,000 shares of $1.00 par value each. Col. John Carson, of Montreal, is president, Mr. James Cooper, secretary-treasurer, and Mr. S. W. Cohen, general manager.

The company produced to December 31st, 1911, 12,512,377 ounces of silver, and paid in dividends $3,714,509.40.

The general manager's report shows that 548 feet of sinking and raising, 2,642 feet of drifting, 1,600 feet of cross-cutting, and 215,746 cubic feet of stoping, have been done during the year. The main shaft is now a depth of 300 feet, with levels every 100 feet. A winze has been sunk on the Carson vein from the third level to a depth of 220 feet, with a level run at a depth of 150 feet, where 125 feet of drifting has been done.

A large part of the ore has been produced from the Carson vein which has been opened up for its full length of 285 feet on both the first and second levels and also for some distance on the third level. The following veins have also been producers: Nos. 2, 8, 9, 14, 17, 17a, 23, 24, 28 and 29. The ground has been explored by cross-cuts driven north and east on both the first and second levels. The east drift on the second level is 965 feet in length and was driven along the north boundary of the Kerr lake line.

The ore is roughly sorted underground, hoisted separately, and delivered into separate bins. The low-grade is then crushed, sized and treated in two Richards pulsating jigs. The fine material is reground by rolls and treated on a Wilfley table.

During the year the company contracted with the Nova Scotia Mining Company to treat their milling ore at the rate of 75 tons per day. An aerial tramway was constructed from the Crown Reserve to the Nova Scotia.

A drift is being driven from the 450-foot level of the Silver Leaf shaft north of the lake to connect with the winze sunk below the 300-foot level.

Drummond

This mine comprises the northwest quarter of the north half of lot 2 in the fourth concession and the southwest quarter of the south half of lot 2 in the third concession of Coleman, and is owned by the Drummond Mines, Limited. The stock of this company is privately owned and no annual report of earnings is published. Mr. R. W. Brigstocke is mine manager.

Mining work was carried on during 1911 from Nos. 1 and 5 shafts. At No. 1 shaft 155 feet of drifting, 160 feet of cross-cutting and 30 feet of raising was done. The principal work was from No. 5 shaft near the southern boundary of the south lot. Here, 1,150 feet of drifting, 235 feet of cross-cutting and 45 feet of raising was accomplished.

The company have recently entered into a contract with the Northern Customs Concentrators, Limited, for treating their low-grade ore.

Gould

The Gould Consolidated Mines, Limited, are working a lease from the Peterson Lake Silver Cobalt Mining Company on Cart lake. The mine was closed part of the year. One shaft has been deepened to the 100-foot level, where cross-cuts were driven north and south 100 feet respectively.

Green-Meehan

This mine has been taken over by the W. S. M. K. Mining Company and work was carried on during part of the year. On the 100-foot level 130 feet of cross-cutting was done and on the 200-foot level 130 feet of drifting and 140 feet of cross-cutting. A winze was sunk 33 feet.

Crown Reserve silver mine, Cobalt.

Hargrave

The Hargrave Silver Mines, Limited, acquired the two 40-acre claims described as the southwest quarter of the north half of lot 2, in the fourth concession, and the northwest quarter of the south half of lot 3 in the fourth concession of Coleman through the purchase of the interests of the White Silver Company, and an arrangement was made with the Ontario Government to pay a royalty on all ore produced. The company have an authorized capital of $2,500,000. Mr. W. N. Ferguson of Toronto is president, Mr. R. D. Moorhead, secretary-treasurer, and Mr. E. V. Neelands, manager. The company secure power from one of the local power companies.

No. 1 shaft, on the north end of the east lot, is 125 feet in depth. No. 3 shaft, on the north end of the south lot, is 375 feet in depth with a winze from one of the drifts on the lower level 50 feet. An exploratory drift was run north on the 375-foot level along the east boundary of the Kerr lake mine, a distance of 950 feet. A connection from this drift to the drift south on the 125-foot level of No. 1 shaft was made by a raise. The drift from No. 1 shaft has been run south 500 feet. An intermediate level 300 feet in length at a depth of 315 feet was run between the north drift from No. 3 shaft and the south drift from No. 1 shaft, and some stoping done.

Hudson Bay

This property consists of 340 acres, situated in the township of Coleman, and is owned by the Hudson Bay Mines, Limited. The company was formerly known as the Temiskaming and Hudson Bay Mining Company with an authorized capitalization of $25,000, shares having a par value of $1.00, and 7,761 shares having been issued. At the annual meeting of the shareholders held in New Liskeard September 27th, 1909, a transfer of the Coleman properties of the Temiskaming and Hudson Bay Mining Company to the Hudson Bay Mines, Limited, for a consideration of 3,000,000 shares of the capital stock was authorized. The Hudson Bay Mines, Limited, have a capitalization of 3,500,000 shares of a par value of $1.00 each, and of this amount 500,000 shares are in the treasury. The directors of this, the pioneer company of the Cobalt camp, are as follows: Geo. A. Taylor, president; A. A. McKelvie, vice-president; S. T. K. McEwen, S. S. Ritchie, D. M. Ferguson, John Dunkin, T. McCamus, directors; F. L. Hutchinson, secretary-treasurer; A. H. Brown, manager. The company originally owned the Silver Queen mine, which was sold for $810,000. The first dividend was declared of 200 per cent. on November 6th, 1905. The total dividends paid by the company to December 31st, 1911, are $1,916,058.76.

The power plant consists of two 80-h.p. boilers, a 15-drill compressor, hoist and electric light plant, and a 20-stamp concentrating mill. Both electric and air power are now being obtained from the power companies.

The Cobalt property, on which all the work has been done during the year, adjoins the Trethewey mine to the north.

The main shaft is now 200 feet in depth with winze sunk 80 feet below the level. Levels have been run at depths of 60 feet, 100 feet, 150 feet and 200 feet. Most of the development work during the year has been done on the third level, where prospect drifts were run north along the east boundary of the claim. Some stoping was also done on the ore blocked out, and the mill run continuously.

The mill is situated to the north of the mine on the slope of the hill, and the ore is hoisted in cars on the cage and dumped into bins at the shaft, and then trammed to the mill. Here it receives very similar treatment to the general scheme outlined for water concentration. Crushing is done by a 20-stamp battery crushing to 20-mesh. The mill has a capacity of about 60 tons per 24 hours.

Kerr Lake

This mine is situated on the northwest part of lot 4 in the fourth concession of Coleman and is operated by the Kerr Lake Mining Company, Limited, which has an authorized capital of $40,000. The capital stock of the company is held by the Kerr Lake Mining Company of New York, with an authorized capital of 600,000 shares of a par value of $5.00 each. Mr. Edward Steindler is president, Mr. J. H. Susman, secretary-treasurer,

Hudson Bay silver mine.

and Mr. Robt. Livermore, manager. The company have paid in dividends to shareholders up to August 31st, 1911, the sum of $3,330,000.

The manager reports that during their last fiscal year the following development work was done: Drifting, 4,441.2 feet; cross-cutting, 2,252.6 feet; raising, 685 feet; winzes, 207 feet; or a total of 7,585.8 feet; and the total development work on the property as 21,946 feet.

Most of the mining work during the year was done on the north end of the property from No. 7 shaft, although stoping was continued on No. 3 vein at the south end. The manager's report shows that the production for the year came from 15 veins, 13 of these being at the north end of the property and partially under Kerr lake.

An ore sorting plant was built during the year. This consists of a bumping table for hand sorting, trommels and jigs. A contract was also made with the Nova Scotia Mining Company for milling the low-grade ore, and an aerial tram was constructed to the property. Owing to the failure of the Nova Scotia Mining Company only a few thousand tons were treated.

La Rose Consolidated

The LaRose Consolidated Mines Company, Limited, own all the stock of the LaRose Mines, Limited, the Lawson Mines, Limited, the Violet Mining Company, and 7,262 shares of the University Mines, Limited. The properties are as follows:—

LaRose Mines, Limited.

LaRose (J. S. 14)	37 acres.
LaRose Extension	36 "
Princess	17 "
Fisher	20 "
Eplett	20 "
Silver Hill	93.5 "

University Mines, Limited.

University	56 acres.

Violet Mining Company.

Violet	40 acres.

Lawson Mining Company.

Lawson	40 acres.
	359.5 acres.

The company have an authorized capitalization of 1,500,000 shares of a par value of $5.00. Mr. D. Lorne McGibbon is president, and Mr. R. B. Watson general manager.

La Rose Mines, Limited

According to the report of the general manager the La Rose Mines, Limited, have produced to December 31st, 1911, 14,902,595.09 ounces of silver, and paid in dividends to former and present owners $3,719,862.72. During the fiscal period from December 31st, 1910, to December 31st, 1911, the shipments amounted to 4,092,709.33 ounces of a net value of $2,014,391.49, or an average of 897.25 ounces per ton of ore. The total cost of production for this period was 19.20 cents per ounce.

La Rose.—At the La Rose mine during this period there were 152.5 feet of shaft sunk; 2,064 feet of drifts run; 3,136.5 feet of cross-cuts driven; 285.5 feet of raising and 7,972 cubic yards of stoping. Mining work is carried on chiefly through the main shaft,

Kerr Lake silver mine, Cobalt.

which is 250 feet in depth, with main levels at 62 feet, 157 feet and 240 feet, and the No. 3 shaft which is 240 feet in depth with levels at 62 feet, 157 feet and 236 feet. Very little stoping was done on the main vein during the year, the production having been derived from the west vein, No. 3, McDonald, and the mill rock on dumps.

Owing to the fault running nearly parallel to the main La Rose vein, the conglomerate to the west has been found to extend to a lower level than that part of the property that has been productive. A winze is therefore being sunk from the 240-foot level with the object of exploring this conglomerate near the Keewatin contact. The winze is now 250 feet in depth.

There were produced from the La Rose during 1911, 1,439,112.68 ounces of silver.

The company have a contract with the Northern Customs Concentrator, Limited, for milling their low-grade ores. During the year, 36,264.491 dry tons were milled, having an average value of 22.04 ounces per ton. From this there were produced 1,146.166 dry tons of concentrates containing 602,539.82 ounces. The net value of these concentrates was $280,738.60, and the cost of concentration $109,515.65, giving a profit to the La Rose Mines, Limited, of $171,222.95. The average extraction in the mill was 75.37 per cent., and the ratio of concentration 1 to 31.7.

Princess.—At the Princess mine during the year, 60 feet of sinking was done; 554.5 feet of drifts run; 1,268.5 feet of cross-cuts driven; 47 feet of raising and 3,578 cubic yards of stoping. The production from the mine was 429,014.12 ounces. The main shaft remains at the same depth, but a winze was sunk from the main drift, second level, 320 feet southeast of the shaft, a depth of 60 feet and 460 feet of drifting and cross-cutting done. Cross-cuts have been driven south from the shaft on the second level and from the east drift distances of 500 feet.

Lawson.—At the Lawson during the year the underground work consisted of 148.5 feet of sinking; 1,353.5 feet of drifting; 1,295 feet of cross-cutting; 352.5 feet of raising and 3,578 cubic yards of stoping. The production from the Lawson during the same period was 1,221,130.64 ounces of silver.

The main shaft was sunk to the 185-foot level and a new level at the No. 8 shaft opened up at a depth of 300 feet. On No. 9 vein, to the west side of the property, a winze has been sunk from the 75-foot level a depth of 60 feet. The greater part of the development work was done on the 185-foot level of the main shaft, there now being 2,400 feet of drifts and cross-cuts on this level.

Violet.—The old shaft on the Violet was unwatered and 201 feet of cross-cutting done on the 100-foot level.

Fisher-Eplett.—These claims are situated north of the Beaver in the southern part of Coleman. About 15,000 feet of trenching was done and a shaft sunk to a depth of 150 feet.

University.—No work was done during the year.

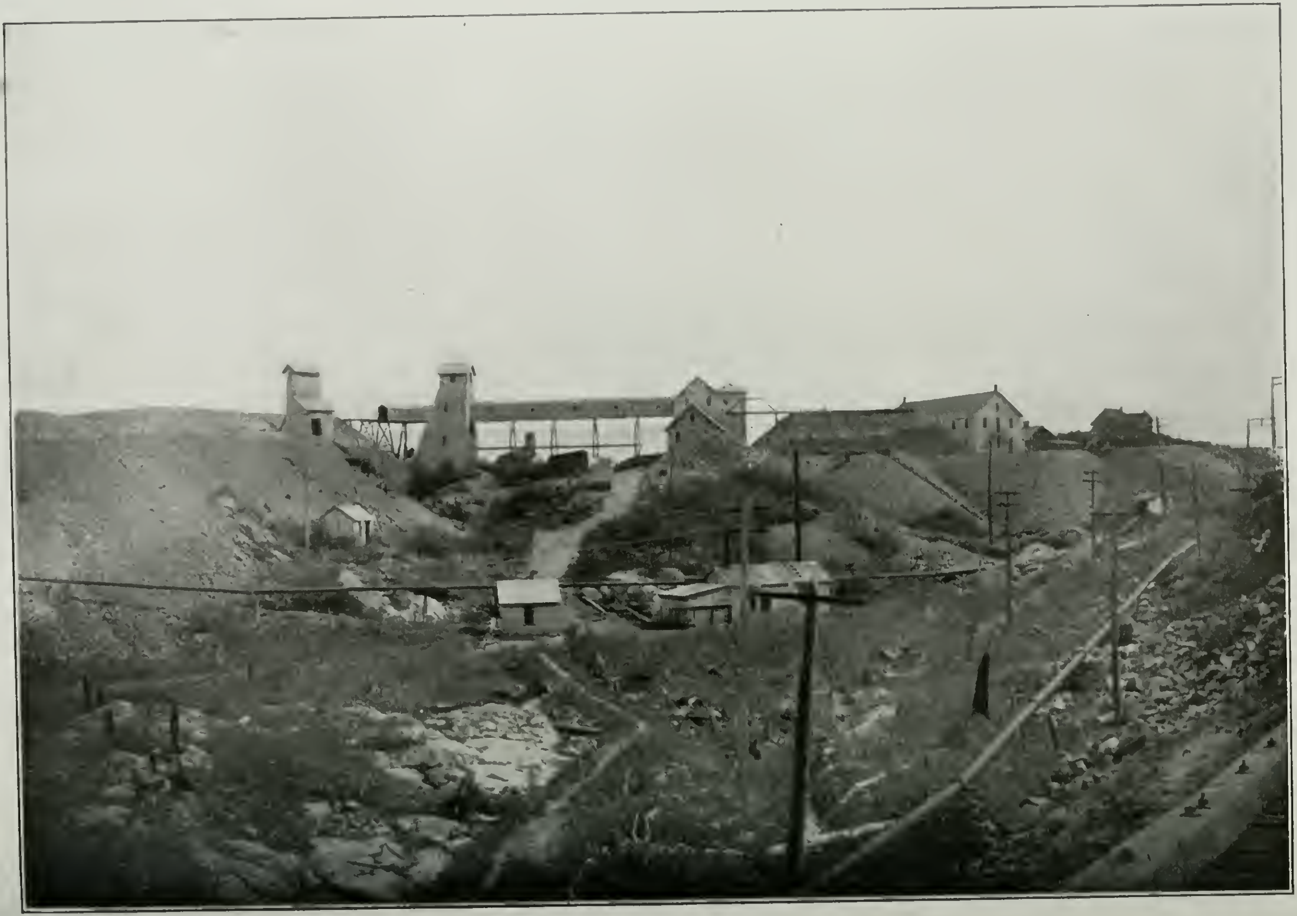
Lumsden

This property, situated on the west half of the northeast quarter of the north half of lot 2 in the third concession of Coleman, was being worked part of the year by the Lumsden Mining Company. The main shaft is 400 feet deep, with some drifting on the 100-foot level, 175-foot level, and 400-foot level. The shaft was sunk in the Keewatin formation for the first 312 feet, where diabase was encountered.

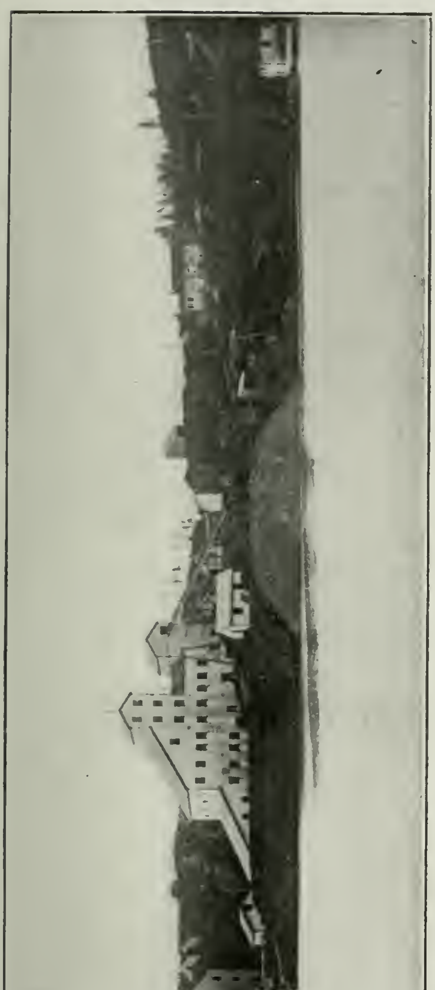
Mr. John Lumsden, of Ottawa, is president, and Mr. F. I. Daniels, manager.

McKinley-Darragh-Savage

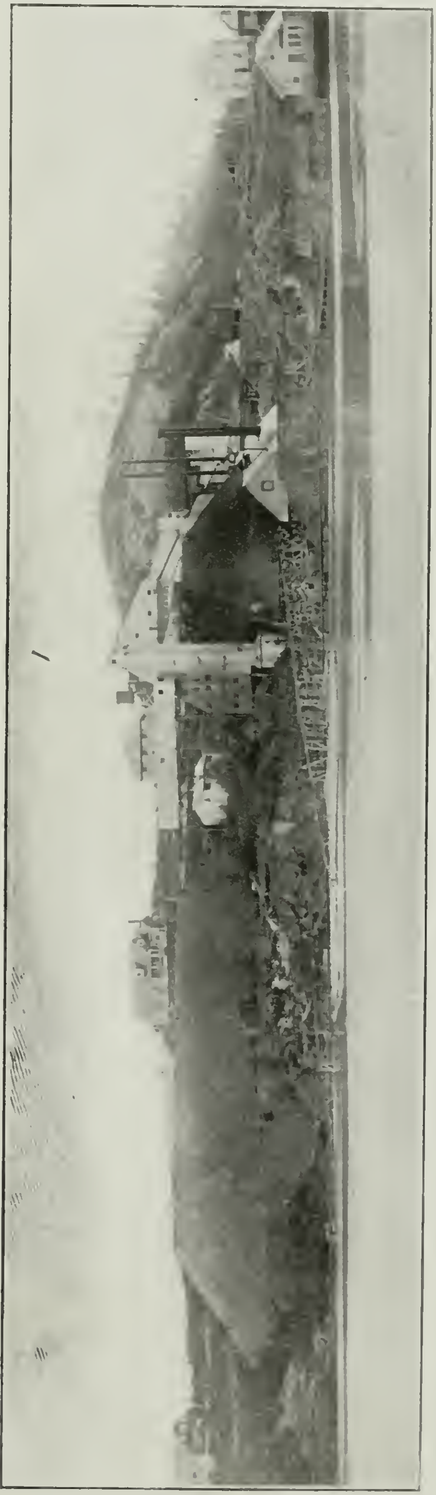
The McKinley-Darragh-Savage Mines of Cobalt, Limited, own and operate the McKinley-Darragh mine at the south end of Cobalt lake, and the Savage mine on lot 3 in the third concession of Coleman, consisting of 42 acres. The company have a capital of 2,500,000 shares, of a par value of $1.00. Mr. C. A. Masten, of Toronto, is president, Mr Thos. W. Finucane, of Rochester, vice-president, and Mr. T. R. Finucane,



Lawson silver mine, Cobalt.

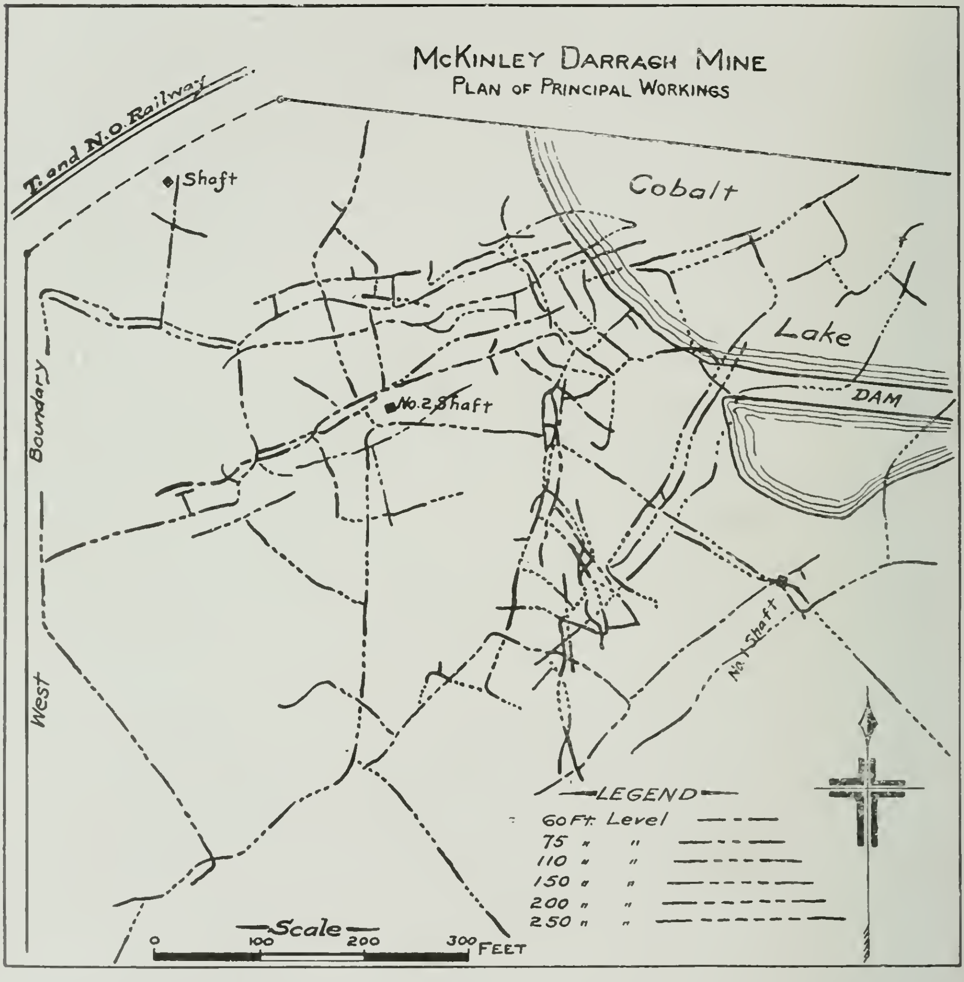


Concentrating mill, Cobalt Lake silver mine, Cobalt.



McKinley-Darragh silver mine, Cobalt.

manager. The company have paid in dividends up to January 1st, 1912, the sum of $2,156,770.88. The total number of ounces of silver recovered at both mines to the above date is 8,652,793.



McKinley-Darragh.—The following table from the directors' report shows the footage advance on the different levels throughout the year and the tonnage taken from the stopes:—

Level.	Drifts.	Cross-cuts.	Raises.	Stopes.
Feet.	Feet.	Feet.	Feet.	Tons.
60	....	....	....	538
75	36.5	54.5	35.5	427
110	304	131.5	128.5	10,426
150	909.5	716	215.5	4,728
200	203.5	162.5	133.5	1,739
230	218.5	....	....	1,162
250	489.5	1386	126.5	2,538
Total.......	2,161.5	2,450.5	639.5	21,558

The total underground footage to January 1st, 1912, is 20,066 feet. The accompanying plan shows the extent of the underground operations, the irregularity of the strike and occurrences and the necessity for extensive exploratory work.

There were recovered 2,043,578 ounces of silver during the year, at a cost of 17.52 cents per ounce.

Savage.—The recovery of silver from the Savage during the year is reported as 610,599 ounces, costing 20.39 cents per ounce.

Four shafts have been sunk to the following depths: No. 1 shaft, 85 feet; No. 2 shaft, 112 feet; No. 3 shaft, 140 feet; No. 4 shaft, 140 feet. A winze was sunk a depth of 50 feet on No. 10 vein near No. 1 shaft, and about 75 feet of drifting done from the bottom of this winze.

The annual report shows that 1,095 feet of drifting, 1,306 feet of cross-cutting 185 feet of raising, 107 feet of sinking, were done, and 14,703 tons of ore stoped during the year. The total underground footage to January 1st, 1912, is 5,955 feet.

The ore-sorting plant at the Savage mine was in operation during the year. This plant consists of crushers, trommels, picking-belt, jigs and sand table. The low-grade ore is put on the dump for future treatment.

McKinley-Darragh Mill.—The mill was run steadily throughout the year and treated 145.91 tons per day, or 46,497 tons during the year. The ore to the mill averages 39.685 ounces, and 1,653,595 ounces of silver were recovered.

Meteor

The Meteor Mining Company were engaged in development work on the northeast quarter of the north half of lot 5 in the fourth concession of Coleman. An adit was driven east a distance of 250 feet and a shaft sunk from the adit level a depth of 104 feet, with 150 feet of drifting and 144 feet of cross-cutting on the 100-foot level. An incline shaft was also sunk from the southwest side of Diabase Mountain, following the contact between the diabase and slate, a depth of 250 feet, and cross-cuts were driven north 190 feet and south 260 feet.

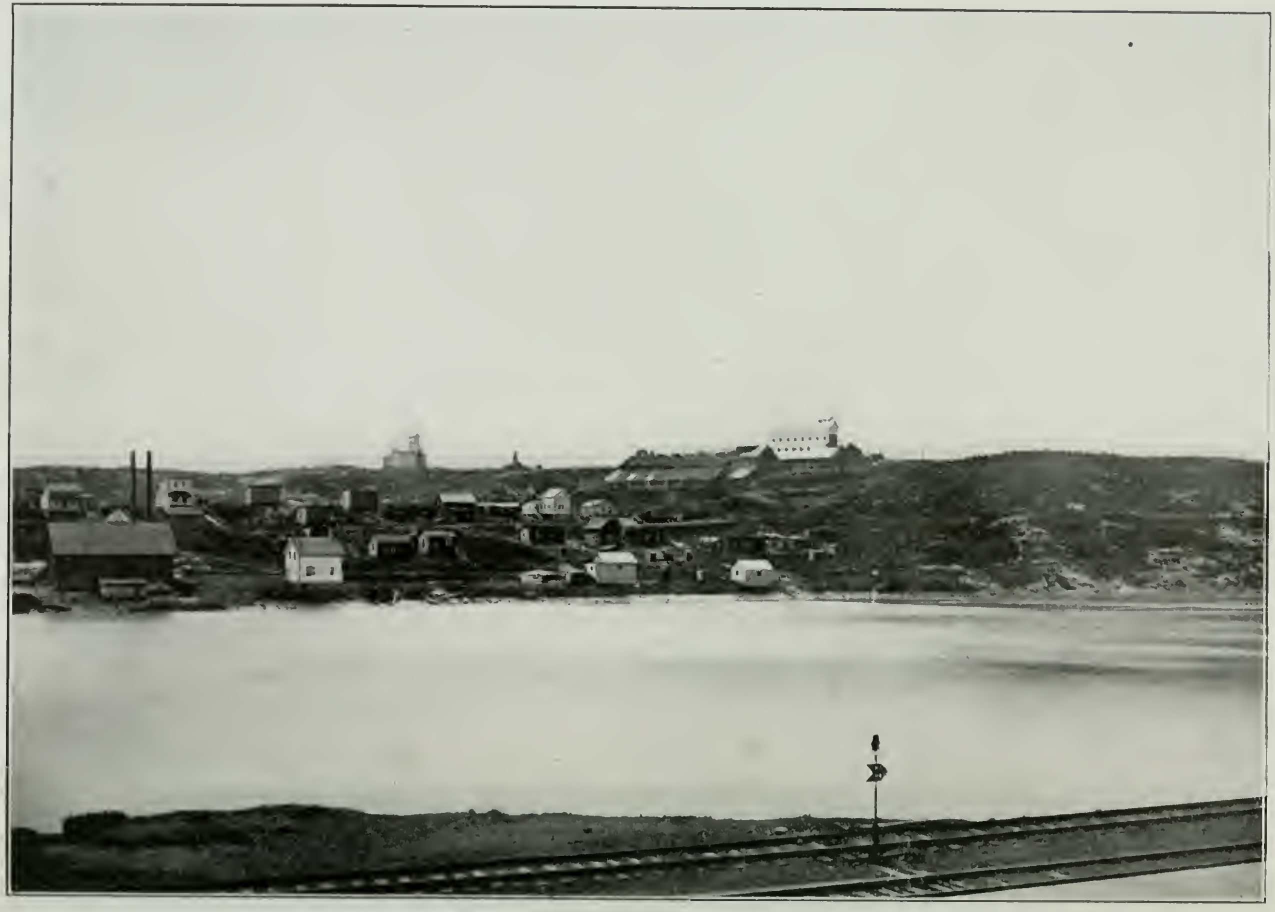
Nipissing

The Nipissing Mining Company, with an authorized capital of $250,000, own and operate 846 acres in the township of Coleman, principally situated in the producing area. Mr. David Fasken, of Toronto, is president, Mr. R. B. Watson, general manager, and Mr. Hugh Park, manager. The Nipissing Mines Company is a holding company, owning all the stock of the Nipissing Mining Company, and has an authorized capital of $6,000,000, with shares of a par value of $5.00. Mr. E. P. Earle, New York, is president, and Mr. Richard T. Greene, secretary. The operating company commenced paying dividends in 1905, and have, up to December 31st, 1911, paid $7,850,930.49 in dividends. The silver production for 1911 was 5,197,042.14 ounces, at a cost of 13.95 cents per ounce, and the total production to December 31st, 1911, has been 23,023,312.92 ounces, for which the company have received from the smelter, $11,820,620.84.

The general manager's report for the year 1911 shows the work done to be distributed as follows:—

Shaft No.	Drifting.	Cross-cutting.	Raising.	Sinking.	Total.
12				18 feet.	18 feet
28	193 feet	269.5 feet.			462.5 “
63	279 “	910.5 “	223.5 feet.		1,413 “
64	627 “	341 “	150 “	75 feet.	1,193 “
73	419 “	878.5 “	215.5 “	87.5 “	1,600.5 “
80	714.5 “	752.5 “	252 “		1,719 “
122	707.5 “	254 “	313 “		1,274.5 “
127	582.5 “	84.5 “	54 “		721 “
141	153	48 “			201 “
150		63.5 “		115.5 feet.	179 “
Total	3,675.5 “	3,602 “	1,208 “	296 “	8,781.5 “

Stoping .... 13,841 cubic yards.



Part of east shore of Cobalt lake, showing concentrating mill of Nipissing silver mine.

The principal producing veins were Nos. 63, 64, 73, 80, 100 and 122. The shaft on vein 63, from which is also worked veins 82 and 108, remains the same depth, namely, 219 feet. The production from these veins was 712,930 ounces. The shaft on vein 64 is 270 feet in depth, with a winze 74 feet deep at a point 550 feet east of the shaft. The vein has been opened up for a length of 900 feet. A cross-cut was driven south on the second level, connecting with vein 73. The production during the year was 833,485 ounces. The shaft on vein 73 has been made the central working shaft for working the vein to the north of the town. It is now connected underground with veins 80 and 100, 600 feet south, and vein 64, 1,100 feet north. A new sorting plant, in which are bumping tables and jigs, has been erected at this shaft, through which all the ore from veins 64, 73, 80 and 100 is hoisted and here treated. The shaft is now 247 feet in depth, with levels at 79 feet, 167 feet and 247 feet. The lower level has been opened during the year. The year's production from veins 73, 80 and 100 was 3,142,198 ounces. The shaft on vein 122 is 168 feet in depth, and on this level drifts have been run east 500 feet and west 200 feet.

The hydraulic equipment was not delivered in time to be set up during the summer, and as a result no prospecting by means of the hydraulic plant was accomplished during the year. The plant was installed during the winter and will be used during the summer of 1912. The equipment consists of a 600-h.p. motor and a turbine pump. This system of prospecting was attempted by this company in its early days, but, owing to insufficient power, it was abandoned. The larger equipment will doubtless be successful in removing the overburden.

A prospect shaft was sunk to a depth of 115 feet near the Savage property, and about 65 feet of a cross-cut driven. The surface prospecting force completed 13.7 miles of trenches during the year.

Low-grade ore from shaft 63 was treated at the customs plant of the Nipissing Reduction Company. The results were as follows:—

Weight of dry ore	14,766.5 tons.
Silver contents of ore	329,417.2 ounces.
Total silver in concentrates	241,902.60 ounces.
Net value of concentrates	$117,843.92
Cost to Nipissing Mining Company	$45,576.52
Profit to Nipissing Mining Company	$72,267.40
Extraction	73.43 per cent.
Ratio of concentration	70.8 to 1.

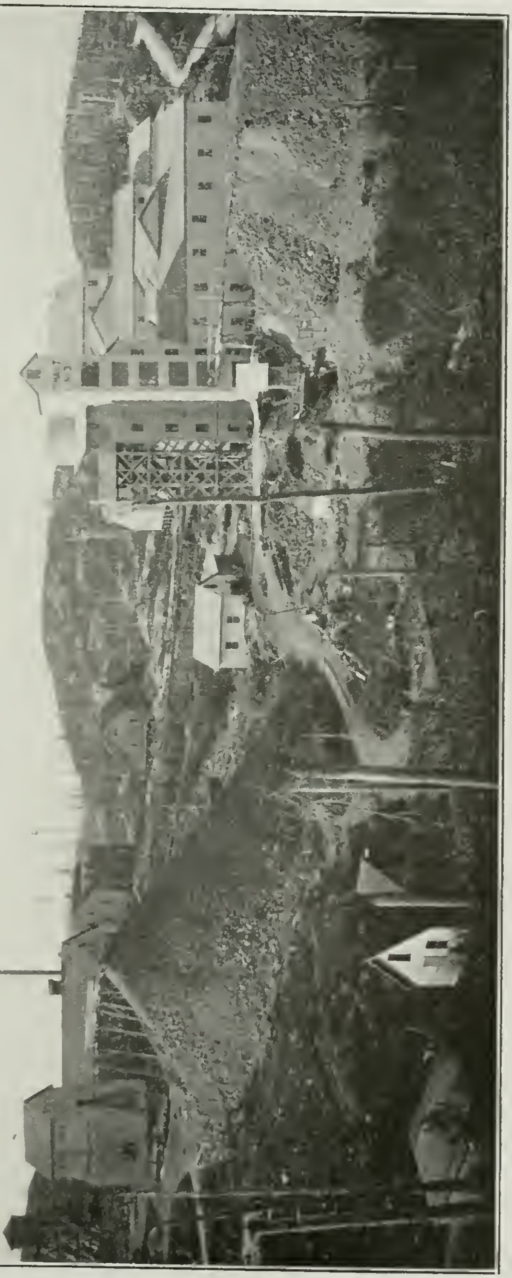
The company's mill for treating high-grade ore was started February 1st, 1911, and is now handling the entire product of the mine. The process was devised by Charles Butters, and his assistant, G. H. Clevenger, and consists essentially of amalgamation in cyanide solution in a tube mill. The residue undergoes the regular cyanide treatment. A refinery was also erected, and the whole product of the mill is shipped as fine bullion.

A new low-grade mill to treat 200 tons per day is now under construction. The ore will be transported to the mill by aerial tramways, where the coarse ore will be removed on a picking belt and the fines jigged. The tailings will be crushed in cyanide solution by 40 stamps of 1,500 lbs. each, and then go to four tube mills, 6 feet in diameter by 20 feet long, where the ore will be reduced to 200-mesh. After tube-milling the pulp will be subjected to amalgamation and the usual agitation in cyanide solution will follow. Precipitation by zinc dust will be carried out in a Merrill filter. The concentrates and precipitates will be further treated at the high-grade mill.

Nova Scotia

Very little underground work was accomplished during the year. The mill was enlarged bringing the number of stamps up to 40. Contracts were made with the Crown Reserve and Kerr Lake Mining Companies for treating their low-grade ore, and

Part of east shore of Cobalt lake, showing high grade mill of Nipissing mine.



Nova Scotia silver mine, showing shaft houses and concentrating mill.

an aerial tram was erected for conveying the ore from these properties to the Nova Scotia. Operations were, however, not successful, and the mill was closed down early in 1912, and the property sold.

O'Brien

This property, formerly known as Mining Location R.L. 403, is situated east of and adjoining the LaRose mine. It is owned and operated by Mr. M. J. O'Brien.

The power plant consists of three 100-h.p. boilers, a 20-drill compressor and hoists, with small boilers at each of the shafts. Both electric and air power is now being obtained from the power companies, but the plant is kept in reserve. A 30-stamp concentrating mill has been in operation since the latter part of 1909.

A new 3-compartment shaft has been sunk at a point about 200 feet from the mill a depth of 325 feet. This shaft has been connected with No. 1 and No. 6 shafts, and it is proposed to hoist all the ore from these veins through this shaft. No. 1 shaft is 1,000 feet west of the main shaft, and is 300 feet deep, with levels at 50 feet, 100 feet, 150 feet, 200 feet and 300 feet. The connection to the main shaft is on the 200-foot level of No. 1 shaft. Considerable stoping has been done above the third level. No. 6 shaft is 240 feet in depth, and has levels at 75 feet, 150 feet and 225 feet. Drifts have been extended east and west from the shaft on each level and stoping done. The second level is connected with the main shaft by a cross-cut north, joining by a winze with the west drift from No. 16 shaft. A cross-cut has also been run from the 250-foot level, and a connection made with No. 16 drift about 800 feet northeast. No. 2 shaft, south of No. 1 shaft, is 235 feet deep, with levels at 65 feet, 165 feet and 225 feet. Considerable drifting has been done on each level and stoping begun. No. 14 shaft is 185 feet deep, with levels at 110 feet and 180 feet. On both levels drifting and cross-cutting have been done. On the 115-foot level of No. 16 shaft a drift has been run west 400 feet. About 400 feet of drifting has also been done on the No. 16 vein, 70 feet east of the shaft.

At the mill, as at the Nova Scotia, cyanide treatment has been adopted. The ore is first crushed by a gyratory crusher and passes over trommels. The trommels separate it into three sizes, which are jigged. The tails from the jigs are crushed in a 30-stamp mill and the product classified, the slimes going direct to a Dorr thickener and the sands reground in two Hardinge mills and treated on Deister tables, the tailings being returned to the classifier. The pulp from the thickener is then run into Pachuca agitators and subjected to the cyanide solution. After agitation, the product is pumped through a Moore filter press and the solution run to precipitation tanks.

An electric tramway has been built from No. 1 and No. 6 shafts to the mill, to handle the ore that is hoisted and also to move the milling dumps.

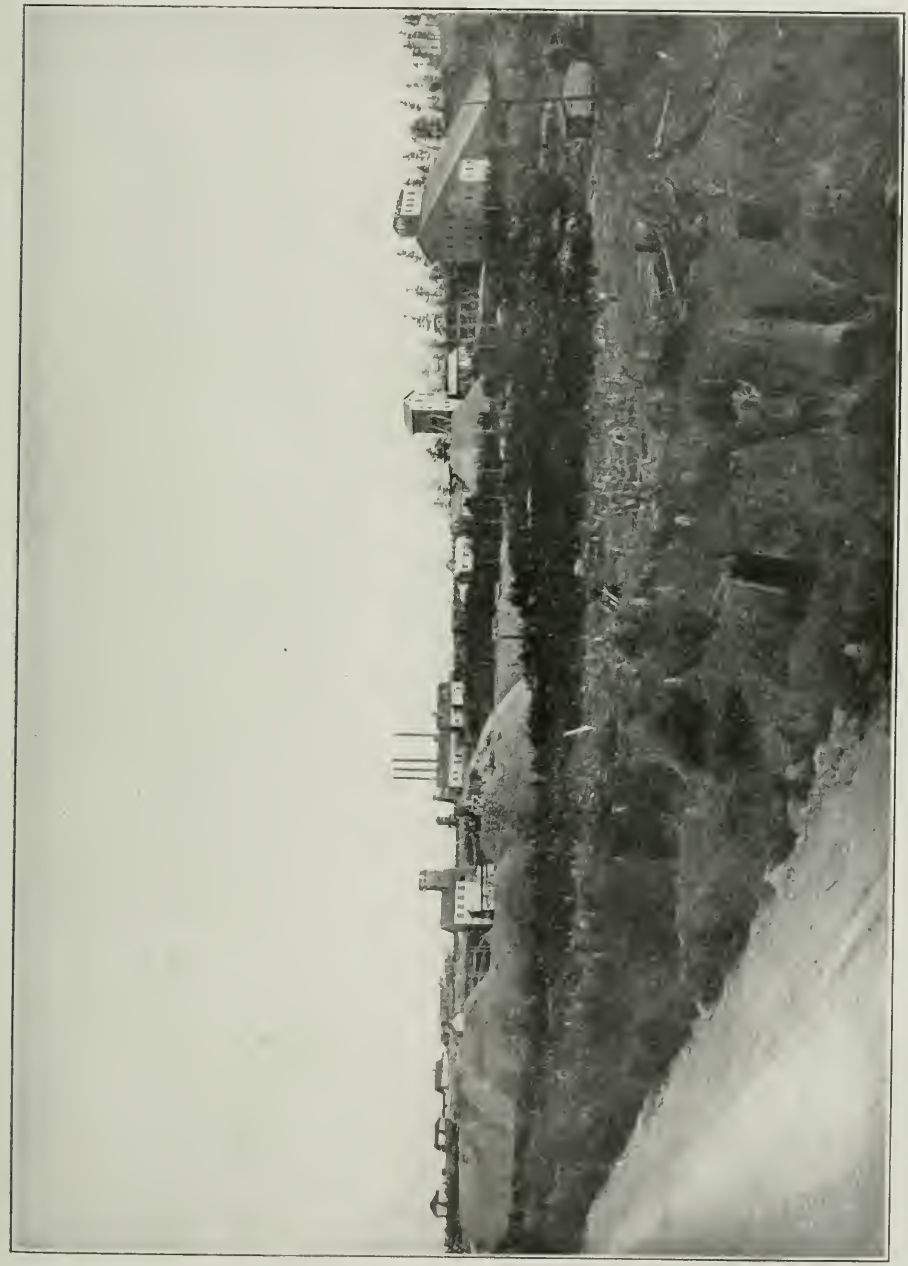
Ophir

On the east half of the northeast quarter of the north half of lot 2 in the second concession of Coleman the Ophir Cobalt Mines, Limited, of which Mr. E. P. Rowe is managing director, have been engaged in prospecting and development work. A shaft has been sunk to a depth of 300 feet, and levels run at 100 feet, 180 feet and 300 feet. On the first level 80 feet of drifting has been done. On the second level 300 feet of drifting and 200 feet of cross-cutting have been done south of the shaft, and 375 feet of drifting and 60 feet of cross-cutting north of the shaft. On the third level a drift has been run north 140 feet, and cross-cuts driven west 240 feet and east 170 feet.

The plant consists of a 100-h.p. boiler, 6-drill compressor, and hoist.

Peterson Lake

The property of the Peterson Lake Silver Cobalt Mining Company, Limited, consists of about 200 acres, made up of the bed of Peterson lake and 33 feet of the road allowance around the lake. Sir Henry Pellatt is president, Mr. G. F. Morrison, secretary-treasurer, and Mr. M. B. R. Gordon, manager. The company have cancelled all the leases except that of the Kerry Mining Company and the Gould Consolidated Mining



O'Brien Silver Mine, Cobalt.

Company. The company are now working what was formerly known as the Little Nipissing mine, the lease of the Little Nipissing Mining Company having been cancelled.

The main shaft is 160 feet in depth, with levels at 100 feet and 155 feet. On the 155-foot level, at a point 450 feet east of the shaft, a winze has been sunk 120 feet, with levels at 70 feet and 120 feet. Drifting and some stoping have been done on both these levels, but during 1911 the work was confined chiefly to the lower level, where a drift was begun to connect with the main shaft and was driven to within 75 feet of it. A drift was also run east, where another winze was sunk 55 feet. This level is at a total depth from the surface of 330 feet, and 300 feet of drilling and cross-cutting have been done.

Right of Way

The Right of Way Mining Company in 1906 purchased the mining rights of the Temiskaming and Northern Ontario Railway Commission from Mileage 101 to 104 (excepting the west shore of Cobalt lake). This company was capitalized for $500,000, with shares of a par value of $1.00, and paid in dividends to October 1st, 1909, $324,643.93. The Right of Way Mines, Limited, was incorporated September, 1909, with an authorized capital of $2,000,000, to take over the assets of the Right of Way Mining Company, and 1,000,000 shares of the Cobalt Merger, Limited, who own 92 acres immediately south of the Hargrave mine. The new company distributed 1,500,000 shares amongst the shareholders of the old company on the basis of three shares for one share, and 185,500 shares for the Cobalt Merger shares, leaving 314,500 shares in the treasury.

The president of the new company is Mr. Geo. Goodwin, secretary-treasurer, Mr. E. A. Larmouth, and superintendent, Mr. R. F. Taylor.

All work during the year has been confined to the No. 3 and No. 4 shafts, west of the Princess and McKinley-Darragh mines, the former being 75 feet and the latter 120 feet deep. A cross-cut has been driven from No. 3 shaft south 350 feet, and north 375 feet, where No. 2 vein was encountered. A winze was sunk on this vein a depth of 45 feet. Drifts were run on the vein on both levels and stoping done. The cross-cut was further extended 400 feet to No. 5 vein, where the No. 4 shaft has been sunk to the 120-foot level. Drifts were run on No. 5 vein on both levels, and on the second level a cross-cut driven north 100 feet. On the first level the cross-cut has been extended north a further distance of 200 feet, cutting veins 6 and 7, on which some drifting has been done. About 300 feet of drifting was done on the Right of Way property, from the 85-foot level of the Little Nipissing shaft on J.B. 2.

Seneca-Superior

The Seneca-Superior Silver Mines, Limited, have taken over the leases on Peterson and Cart lakes formerly held by the Kerry Mining Company. No. 1 shaft on Cart lake is 100 feet deep, and 300 feet of drifting and cross-cutting has been done at this level. No. 2 shaft on Peterson lake is 200 feet deep, with levels at 125 feet and 200 feet. On the second level a cross-cut has been driven south 350 feet, and a winze sunk from this level at a point 190 feet south of the shaft a depth of 112 feet. Drifts have been run on veins encountered in cross-cuts distances of 250, 75, and 150 feet respectively. The mine was in operation only part of the year.

Silver Cliff

This property, consisting of the southeast quarter of the south half of lot 3 in the sixth concession of Coleman, and owned by the Silver Cliff Mining Company, Limited, was taken over by the present owners in June, 1909. The company have an authorized capital of $2,000,000, with shares of a par value of $1.00. Mr. A. R. Peacock is president.

The mine and mill were operated part of the year, but all work has now ceased. The last work done by the company was to sink a shaft on the shore of Cross lake a depth of 140 feet and cross-cut east and west distances of 100 feet. The other part of the property was developed by means of an adit driven into the hill a distance of 340 feet. Drifts were run from this adit on the veins encountered. Over 3,000 feet of development work was done.

Sutherland

On the southeast quarter of the north half of lot 5 in the first concession of the township of Bucke, the Sutherland Cobalt Silver Mines, Limited, have sunk a shaft a depth of 125 feet.

A small plant was erected, consisting of a 50 and a 60-h.p. boiler, a 3-drill compressor and hoist.

Temiskaming

This property, consisting of the south half of the northeast quarter and the west half of the southwest quarter of the north half of lot 1 in the third concession of Coleman, is owned by the Temiskaming Mining Company, which have an authorized capital of 2,500,000 shares, of the par value of $1.00. Mr. Burr E. Cartwright is president, Mr. Alex. Fasken, secretary-treasurer, and Mr. Norman R. Fisher, general manager. The dividends paid to December 31st, 1911, amount to $1,009,155.56. The production of the mine for 1911 was 1,213,754 ounces, costing 29.8 cents per ounce to produce; and for the total period since commencement of operations, 5,191,393 ounces.

The plant consists of four 100-h.p. boilers, an 18-drill compressor, a double-drum first-motion hoist and an electric light plant. The company now secure their electric and air power from the British Canadian Power Company. Their main hoisting shaft is equipped with a 60-foot steel head-frame. A 40-stamp concentrating mill and ore-sorting house are also in operation.

The main 3-compartment shaft is 628 feet in depth, being the deepest shaft in the Cobalt camp. The mining work during the year was made up as follows: shaft sinking, 112 feet; winzes, 193.2 feet; raises, 160.6 feet; drifting, 2,184.2 feet; cross-cutting, 936 feet; and 6,935 cubic yards of stoping. The total lineal footage of work done underground since the commencement of operations amounts to 12,810 feet, and the stoping to 22,224 cubic yards. The main levels now being worked are at depths of 200 feet, 300 feet, 400 feet, 450 feet, 500 feet, and 575 feet. From a winze 360 feet south of the shaft a sub-level was driven at a depth of 450 feet. The main shaft is connected with the No. 1 shaft on the 200-foot level. The main drift, north and south, exclusive of drifts and cross-cuts on other veins, is 650 feet on the 300-foot level, 600 feet on the 400-foot level, 600 feet on the 500-foot level, and 400 feet on the 575-foot level. A cross-cut is being run east on the 575-foot level, it being the intention to continue this to the eastern boundary of the claim, a distance of 800 feet.

The company did some development work during the year on their Peterson claim in the township of Bucke near North Cobalt. A shaft was sunk 53 feet and 93 feet of cross-cutting was done.

The concentrating mill was erected on the northeast corner of the property the latter part of 1909. The mine ore is first hand-sorted and crushed at the ore-sorting house at the shaft and delivered to bins, from which it is carried by aerial tramway to the storage bins at the mill. It is then sized by trommels and treated in three Richards jigs. The finer product is classified, the sands treated on three James sand tables and the overflow on two James slime tables. The tailings from the jigs and tables are dewatered and recrushed by 40-stamps using a .069-inch slot screen, then classified, the sands being treated on eight James and one Deister tables, and the overflow on nine James and one Deister slime tables. The middlings from the sand tables are classified and re-treated.

Trethewey

This property is owned and operated by the Tretheway Silver-Cobalt Mine, Limited, of which Mr. Alex. M. Hay is president and Mr. Chas. A. McConnell manager. The company have an authorized capital of 2,000,000 shares of a par value of $1.00. Only 1,000,000

Concentrating mill, Trethewey silver mine, Cobalt.

shares have as yet been issued and $200,000 paid in dividends during 1911. The total dividends paid by the company, exclusive of the original owner's profits, amount to $761,998.50. During 1911, 770,838 ounces of silver were produced, yielding $372,622.45.

The development work done during the year is as follows:—

Drifts and cross-cuts	2,801 feet.
Raises and winzes	168 feet.
Shafts	102 feet.
Total	3,071 feet.

The total development work done to date amounts to 14,348 feet.

No. 2 shaft is the main hoisting shaft for the southern part of the property, and from this shaft there is a tramway to the mill. This shaft is 250 feet deep and connected with No. 1 and No. 3 shafts. From the 100-foot level of No. 2 shaft a cross-cut has been driven north about 760 feet, where a vein was cut and a raise put through to the surface. This raise is to be used as a hoisting shaft, from which this vein will be developed. No. 4 shaft is at the north end of the property, 140 feet from the Hudson Bay boundary, and is 200 feet in depth. Work is being done on both the 150-foot and the 200-foot levels.

The concentrating mill is located on the west side of the hill, about midway between No. 1 and No. 4 shafts. The ore passes over a picking table, is then crushed and sized by a trommel and treated in four jigs. The tailings are recrushed in a 30-stamp mill. After being classified the sands are treated on seven James tables and the slimes on nine James slime tables.

Northern Customs Mill

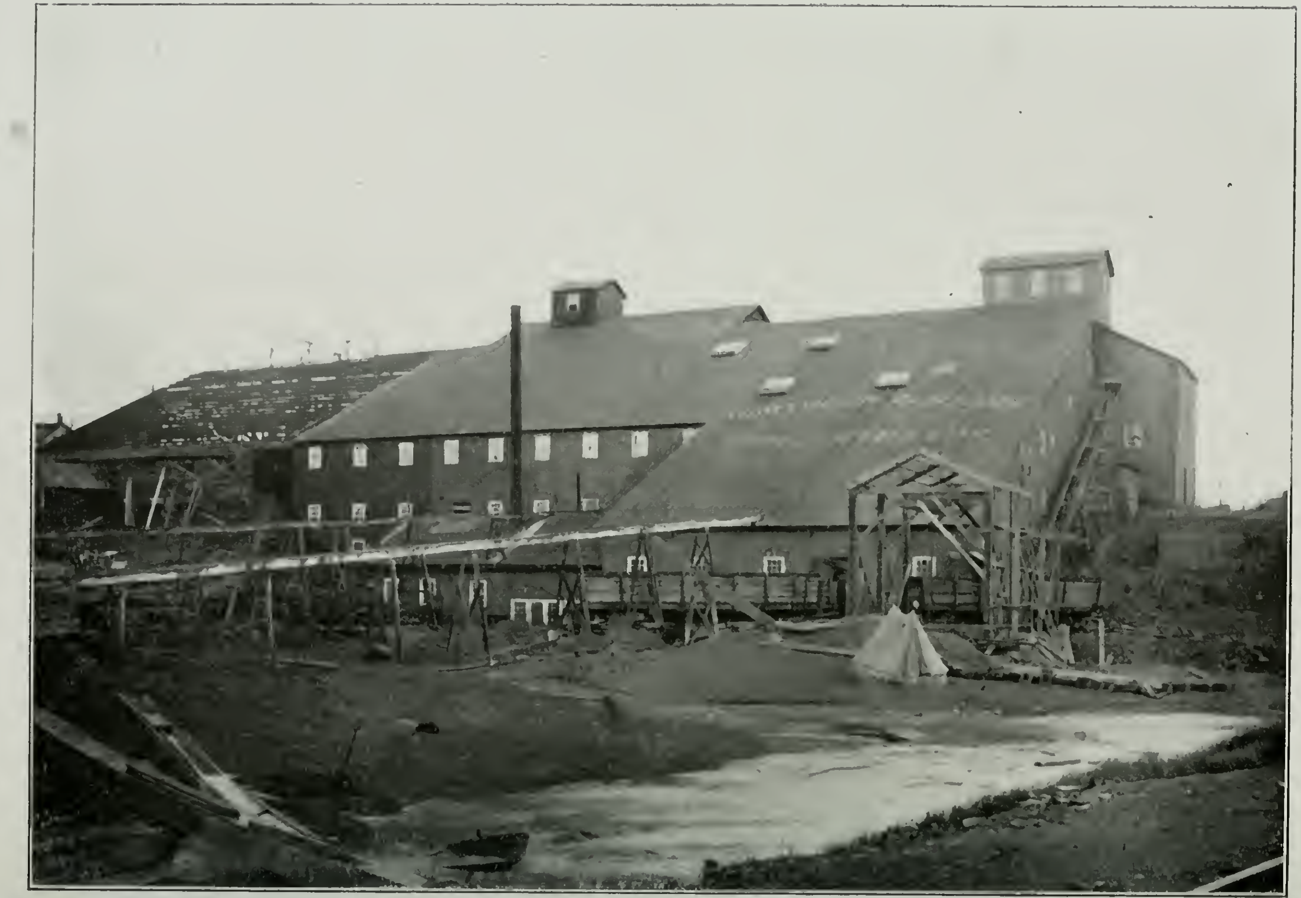
The Northern Customs Concentrator, Limited, is an independent company, operating a custom concentrating mill for treating low-grade silver ores. The company has an authorized capital of $250,000. Mr. A. J. Young is president, Mr. F. J. Bourne, consulting engineer, and Mr. M. F. Fairlie, superintendent. The mill is situated on the townsite of Cobalt, south of the railway station.

The company have a contract with the LaRose Mines, Limited; City of Cobalt Mining Company, Limited; the Cobalt Townsite Mining Company, Limited, and the Drummond Mines, Limited, for treating their low-grade ore. The ore averages from 20 to 30 ounces per ton, and a saving of from 75 to 80 per cent. of the silver contents is made. All the ore is weighed when entering the mill, so that the tonnage treated is accurately known. Electric power for driving the mill machinery is obtained from the British Canadian Power Company. This is the largest concentrating mill in the Cobalt camp, having now a capacity of about 280 tons per 24 hours. The company either treat the ore at a rate per ton, or pay for a specified percentage of the silver saved. The company recently added to their capacity, having now one hundred and ten 1,250-pound stamps and four Nissen stamps.

The ore is first passed through a Gates crusher, and then sent to rolls, where it is reduced to a ¾-inch product. From the rolls it goes through a Vezin sampler and then through a trommel. The different trommel products, except the fines, are sent to the jigs. The fines go to a classifier, and the fine product from this goes direct to the Wilfley tables, while the coarse is recrushed by the stamps along with the jig tailings The stamps crush to about 16-mesh. The stamp product is classified, the sands going to the Wilfley tables and the overflow to Callow tanks and then to vanners. The tailings from the vanners again go to a classifier, and the spigot discharge to waste, while the slimes are led over canvas tables.

Nipissing Reduction Mill

The custom plant of the Nipissing Reduction Company, Limited, situated on the Nipissing property, near the Kendall shaft, has a contract with the Nipissing Mining Company for treating the low-grade ores from vein 63 (Kendall).



Northern Customs concentrator, Cobalt.

The method of concentration at this mill is crushing by a series of rolls and jigging the products after each crushing, then regrinding in a Hardinge mill, and classifying and treating the sands on two Wilfley and eight James tables, and the slimes on six slime tables.

South Lorrain

Alice Lorrain

On mining claim R.L. 467 the Alice Lorrain Mines, Limited, have sunk a shaft a depth of 75 feet. No machinery has been installed.

Bellellen

On claim R.L. 470 the Bellellen Silver Mines, Limited, have carried on considerable development work. No. 1 shaft is 80 feet deep, with 144 feet and 114 feet of drifting north and south of the shaft on the 80-foot level; some stoping has been done. No. 2 shaft is 100 feet deep, with 200 feet of drifting and cross-cutting at the 100-foot level.

The plant consists of a 20-h.p. boiler and hoist.

Frontier

The Frontier Mining Company did some development work on their property near Loon lake during 1911. A shaft has been sunk 80 feet and 50 feet of drifting done at this level.

King George

Active development work was carried on during 1911 on claims H.R. 110 and 170. The main shaft has been sunk a depth of 272 feet, with 30 feet of cross-cutting at the 250-foot level.

The power plant consists of a 5-drill compressor, driven by a 75-h.p. motor, and a hoist. Electric power is obtained from the British Canadian Power Company.

Montrose

Work on R.L. 459 was carried on part of the year by the Montrose Cobalt Mining Company. A shaft was sunk a depth of 110 feet.

Sharp Lake

On claim B.C. 100 the Sharp Lake Mines, Limited, have sunk a shaft a depth of 50 feet. At the 50-foot level a drift has been run south 145 feet and east 60 feet.

Wettlaufer

The Wettlaufer is the largest and hitherto the only steady producer in South Lorrain. It is owned and operated by the Wettlaufer Lorrain Silver Mines, Limited, which have an authorized capital of 1,500,000 shares, of a par value of $1.00, and have paid $450,000 in dividends to June 1st, 1912.

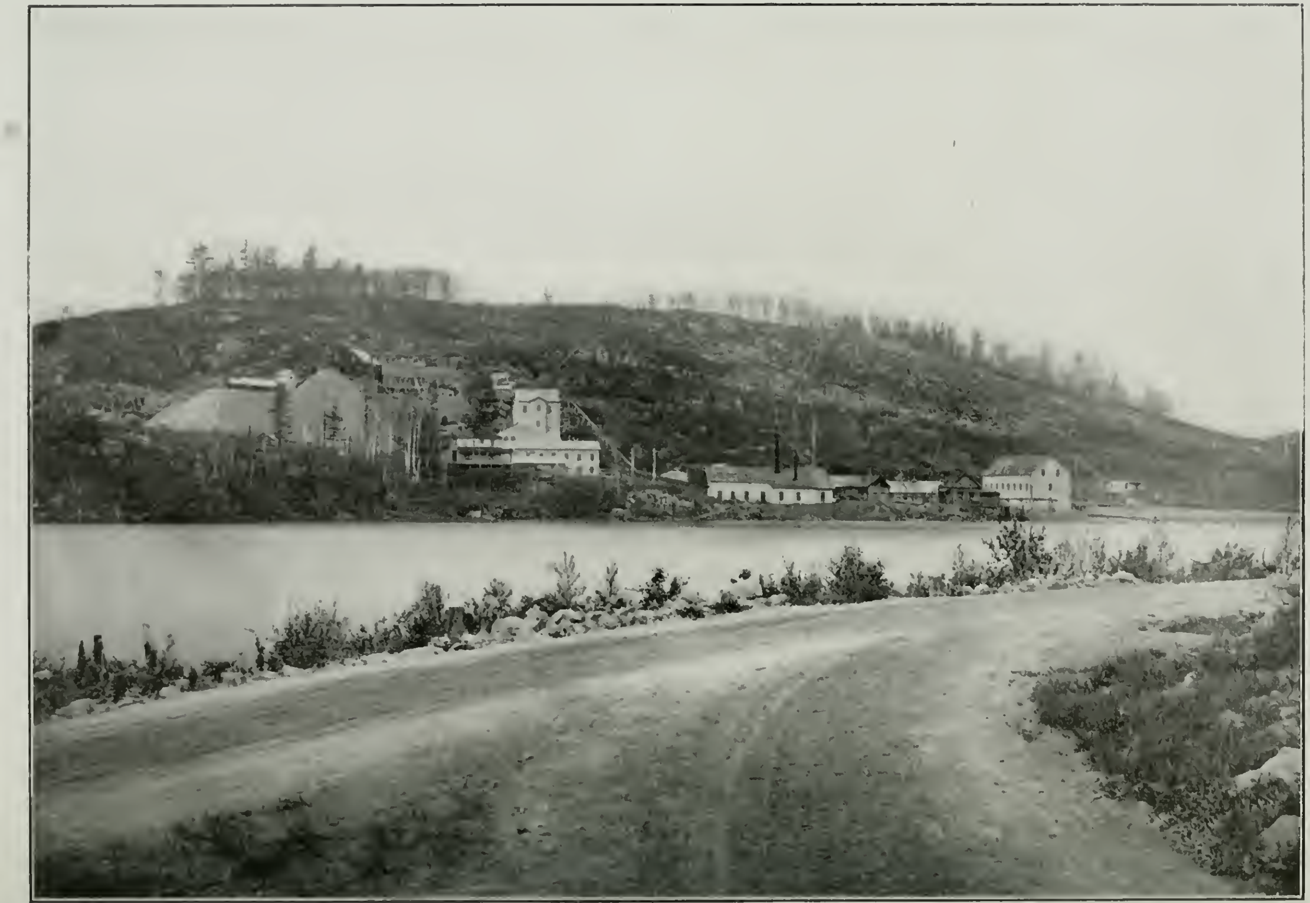
On the advent of electric power to the camp from the British Canadian Power Company, a new plant was installed, consisting of a 12-drill compressor, driven by a 200-h.p. motor. A 30-ton concentrating mill has been erected.

The main shaft has been sunk to the fourth level, a depth of 250 feet. Levels have been run at depths of 65 feet, 140 feet, 185 feet and 250 feet. The vein has been developed for a length of about 500 feet, the drifts on each level having been run approximately this distance. A winze was sunk at a point 210 feet southwest of the shaft from the fourth to the fifth level, and a drift run south 160 feet and north 70 feet.

Mr. Halstead Lindsley is mine manager.

Elk Lake Area

There were very few properties on which mining operations were carried on during 1911. A few that were worked for a short time are not mentioned in this Report.



Penn Canadian silver mine (Cobalt Central), showing road built of broken diabase.

Donaldson

This property is known as T.R. 531, situated in the township of James, and the work is under the direction of Mr. H. L. Donaldson. A small plant, consisting of a 25-h.p. boiler and hoist, has been erected. A shaft has been sunk 110 feet and 17 feet of drifting done.

Hitchcock

Work was recently begun on the Hitchcock property, situated on lot 11 in the third concession of the township of Tudhope. A new plant was erected during the winter, consisting of two 60-h.p. boilers, a 6-drill compressor and hoist. A shaft has been sunk 70 feet.

Moose Horn

The Moose Horn Mines, Limited, were engaged part of the year in mining work on the north half of the north half of lot 4 in the fifth concession of James. The main shaft remains at the same depth of 125 feet, with several hundred feet of drifting done at the level.

Lucky Godfrey

The Lucky Godfrey Cobalt Mines, Limited, did some work on claims J.S. 202 to 207, in the townships of James and Willet. In addition to prospecting on the surface a shaft was sunk 100 feet, a drift run west 68 feet and cross-cuts driven north and south 120 feet.

Gowganda Area

The Millerett and Miller Lake-O'Brien mines were steady producers during 1911. On a number of other properties development work was in progress.

Calcite Lake

Near Calcite lake, in the township of Lawson, the Calcite Lake Mining Company were engaged in development work, with Mr. E. H. York, superintendent.

The power plant consists of one 30 and one 50-h.p. boiler, a 3-drill compressor and hoist. A shaft has been sunk to a depth of 275 feet, with levels at 100 feet, 150 feet, 200 feet, and 270 feet. About 400 feet of drifting and cross-cutting has been done.

Hudson Bay

The Hudson Bay Mining Company have been developing a property near Hanging Stone lake, south of Gowganda lake. A plant has been erected consisting of two 50-h.p. boilers, one 12-h.p. boiler, a 3-drill compressor and hoist.

A shaft has been sunk 110 feet and some drifting done at the 80-foot level.

Chicago-Gowganda

The Chicago-Gowganda Mines Company, Limited, have been carrying on development work on claim M.R. 3794, Shillington township. The main shaft is 185 feet deep, with levels at 75 feet and 171 feet. On the first level a cross-cut has been run north 47 feet and 94 feet of drifting done. On the second level a cross-cut has been driven north 40 feet and 23 feet of drifting done.

Mann

There was but little work done by the Mann Mines, Limited, during 1911. Preparations were being made early in 1912 for resuming operations.

Millerett

The Millerett Silver Mining Company have been the largest shipper in the Gowganda and Elk lake areas. The first work done was driving an adit on the vein. This has a length of 275 feet, and 200 feet of the vein above the adit has been stoped to within

10 feet of the surface. The vein dips to the west at an angle of about 65 degrees. Shaft No. 1 is sunk vertically near the mouth of the adit to a depth of 83 feet. The level is at 70 feet, and drifts have been run southwest 175 feet and northeast 120 feet, and then north 550 feet to No. 7 shaft. A raise has been put through from this level to the adit level, and stoping carried on from each side of the raise. At a point in the drift 150 feet southwest of the shaft a winze has been sunk 60 feet, and 120 feet of drifting and 50 feet of cross-cutting done from this winze level. From the adit level a cross-cut was driven west to No. 2 vein.

No. 3 shaft has been sunk 56 feet, and 196 feet of drifting done at the 50-foot level.

No. 7 shaft is 210 feet deep, with levels at 70 feet, 150 feet, and 210 feet. The drift from No. 1 shaft connects with this shaft on the first level. On the second level 500 feet of drifting and cross-cutting has been done, and on the third level 150 feet. Some stoping has been done on both the second and the third level.

No. 9 shaft is 33 feet deep, with 170 feet of drifting done.

A new plant, consisting of three 80-h.p. boilers and a 12-drill compressor, was installed during the winter, and a 10-stamp concentrating mill erected.

Mr. G. M. Colvocoresses is mine manager.

The Millerett mill has adopted much the same principle of concentrating as is applied in the concentrating mills at Cobalt. The ore is first passed over a picking table, then through a Blake crusher, over trommels and to jigs. The jig tailings are then recrushed to 10-mesh by ten 1,250-lb. stamps, and the product is classified, the sands going to two Deister tables and the overflow to a Callow tank. The table tailings are reground in a Hardinge pebble mill, and classified, the sands going to two Deisters and the overflow to a Callow tank. The product from the tank is treated on a James table and then on canvas tables, and the tailings run to waste. The mill has a capacity of about 30 tons per day.

Miller Lake-O'Brien

This mine is the second largest shipper in the Gowganda area. The plant consists of two 50-h.p. boilers, two 100-h.p. boilers a 6-drill compressor and two hoists.

The main shaft is now 250 feet in depth, with levels at 60 feet, 90 feet, 140 feet, 200 feet and 250 feet. The work during 1911 has been chiefly on the three lower levels. On the third level 450 feet of drifting has been done and stoping carried on for 200 feet along the vein. On the fourth level 150 feet of drifting was done, and on the fifth 300 feet. A winze connects the third, fourth and fifth levels. A stope has been started south of the main shaft.

Northern

On what was formerly known as the Morrison claims, near Miller lake, the Northern Mining Company have sunk a shaft 95 feet and drifted 175 feet at the 90-foot level.

Powerful

The Powerful Mining Company have been engaged developing a property near Calcite lake. The plant consists of an 80-h.p. boiler and a 3-drill compressor. An adit 700 feet in length has been run and 250 feet of drifting and cross-cutting done.

South Bay

Work was started late in the year by the South Bay Mining Company of Gowganda on claims H.F. 225 and H.S. 123 and 124 in the township of Milner, south of Gowganda lake. No plant has as yet been erected, the mining work being done by hand. A shaft 45 feet in depth has been sunk.

Larder Lake Gold Area

An inspection of this area was made in September, 1911, at which date but little mining work was in progress.

Canadian Tonapah

On claims J.S. 127 and 128, in the township of McVittie, the Canadian Tonapah Company were doing a little work. Prospect shafts were sunk to depths of 14 and 30 feet.

The plant consists of a 25-h.p. boiler, engine, and 3-stamp mill.

Goldfields

Work was carried on by the Goldfields, Limited, on the property formerly known as the Harris-Maxwell. The shaft was sunk a depth of 110 feet, and a cross-cut run 20 feet on the 100-foot level.

A 30-stamp mill is being erected. A power plant for developing electricity is being installed at Ravens falls, which will be used for operating the machinery at the mine.

Reddick

The Dr. Reddick Larder Lake Mines, Limited, were operating their property part of the year. The mining work done to date consists of a shaft 80 feet deep, with 400 feet of drifts and cross-cuts at this level.

The plant consists of three boilers of 15 25, and 60 h.p. capacity, a 3-drill compressor, hoist, crusher and 20-stamp mill.

Swastika Gold Area

There was considerable activity in this area during 1911. A large number of claims were staked and assessment work performed. Two properties on which extensive development work was carried on were the Lucky Cross and Swastika.

Lucky Cross

The Lucky Cross Mines, Limited, own three claims in the township of Teck, situated south of and adjoining the Swastika townsite. A shaft has been sunk a depth of 100 feet, with cross-cuts driven west 216 feet, east 220 feet, northeast 170 feet, and 155 feet of drifting done on veins encountered.

A plant consisting of a 125-h.p. boiler, 6-drill compressor and hoist has been erected.

Swastika

The property of the Swastika Mining Company, Limited, consists of three patented claims in the township of Otto and two patented claims in the township of Teck, comprising 200 acres. They hold in addition mining claims 16,358 and 16,359 in the township of Otto, and 12,619, 16,418 and 16,419 in the township of Teck, containing 165 acres. The greater part of the development work has been done on what was known as claim R.S.C. 204 in the unsurveyed part of the township of Teck, and on claim 9,592 in the township of Otto. Both of these claims are on the northeast end of Otto lake and about one-third of a mile from Swastika station, T. & N. O. railway. The company have an authorized capital of 2,000,000 shares, of a par value of $1.00. Dr. M. Steele is president, Mr. Jas. Clark, Toronto, secretary-treasurer, and Mr. John Redington, manager.

The extent of underground workings, as shown by the manager's report, both for the year 1911 and total work accomplished, is as follows:—

Class of work.	Level.	During 1911.	Total to Dec. 31, 1911.
Sinking		229 feet.	424 feet
Raising		185 "	185 "
Drifting	35-foot.	35 "	70 "
"	100 "	501 "	501 "
"	200 "	93 "	93 "
Cross-cutting	35 "	....	342 "
"	100 "	351 "	491 "
"	200 "	287 "	287 "
Total		1,681 "	2,393 "

The depth of the main shaft is 320 feet, with station cut at the 300-foot level, and 175 feet of drifting done at this level.

The power plant consists of two 125-h.p. Jenckes return tubular boilers, a 9-drill compressor, a double drum hoist and an electric light plant.

A 5-stamp mill was erected in the early part of 1911, and 520 tons of ore milled.

Munro Township

Several gold mining companies were engaged in prospecting work during the summer of 1911 in the townships of Munro and Guibord. The only properties on which underground work was being done at the date of inspection were the American Eagle and Gold Pyramid.

American Eagle

This property is situated on lot 10 in the first concession of Munro, and is operated by the American Eagle Mining Company. A shaft has been sunk 70 feet, and 30 feet of drifting and 65 feet of cross-cutting done.

The plant consists of two 50-h.p. boilers, a 6-drill compressor, a hoist and a Tremain stamp.

Gold Pyramid

On lots 11 and 12, in the sixth concession of Guibord, the Gold Pyramid Mining Company of Larder Lake, Limited, did some work during 1911. Two prospect shafts were sunk to depths of 27 and 32 feet.

The plant consists of a 60-h.p. boiler, a 5-stamp mill and an engine for driving the same.

Porcupine Gold Area

Development work was carried on by a large number of companies in the Porcupine area during 1911. The disastrous fire of July 10th, 1911, caused a great loss of life and destruction of property, and gave a number of the mining companies a severe setback. As the Temiskaming and Northern Ontario railway had just completed their line to the camp, it was possible to get in supplies and equipment, and a speedy recovery from the effects of the fire was made. Delay, however, was occasioned to the large operators, the Dome Mines, Limited, and the Hollinger Mines, Limited, in the erection of their mills, so that little gold was produced by these companies during the year.

As the geology of the area and a description of the principal mines are given by Mr. A. G. Burrows in another part of this volume, a brief account of the operating mines and prospects only will be given here.

Apex

The Apex Porcupine Mines, Limited, carried on development work on parts of lots 6 and 7 in the first concession of Tisdale. Two shafts were sunk to depths of 55 and 62 feet.

The plant consists of two 60-h.p. boilers, an 8-drill compressor and two hoists.

Armstrong-McGibbon

Mining claims M.E. 60 and 61 in the township of Deloro are being developed by the Armstrong-McGibbon syndicate.

No. 1 shaft has been sunk 40 feet, and 17 feet of drifting done; No. 2 shaft, 45 feet, with 52 feet of cross-cutting; and No. 4 shaft, 45 feet, with 32 feet of cross-cutting.

Cartwright

On part of lot 1 in the first concession of Mountjoy, Mr. B. Cartwright and associates have been carrying on development work. A shaft has been sunk 50 feet, and 30 feet of cross-cutting done.

Crown-Chartered

The Crown Chartered Gold Mining Company of Porcupine Lake, Limited, have an authorized capital of 2,000,000 shares, of a par value of $1.00. Work was confined during the year to the Davidson claim in the township of Tisdale, and was under the supervision of Mr. C. F. Dike. The plant consists of a 20-h.p. boiler and hoist.

The main shaft is 147 feet deep, with level at 100 feet. On this level a cross-cut was driven northwesterly 125 feet, and drifts run on the vein east and west from the cross-cut distances of 100 feet and 75 feet. Cross-cuts were driven from the end of these drifts distances of 20 feet and 35 feet.

Dobie

On the north half of the south half of lot 1 in the fifth concession of Tisdale, the Dobie Mines, Limited, were working during the year. Two shafts were sunk to a depth of 100 feet and 50 feet, and 200 feet of drifting done from the 100-foot level of the deeper shaft. The plant consists of one 60- and one 30-h.p. boiler, a 3-drill compressor and hoist.

Dome

The properties of the Dome Mines, Limited, are situated on the north half of lot 4 in the first concession of Tisdale. Development work underground has been carried on at the 45-foot, 100-foot and 200-foot levels. A change was made in the system of hoisting from the 45-foot level by running an incline shaft 250 feet in length at an angle of about 10 degrees from near the mill to this level. The mine cars will be drawn by mules from the various working places underground to the bottom of the incline, from which place they are hauled up the incline to the rock-house. The 45-foot level is being blocked out into rectangles 100 feet by 160 feet and raises put through to the surface every 50 feet along these drifts and cross-cuts. The ore will be underhand stoped from the surface to these raises. There has been about 1,200 feet of drifting and cross-cutting done on this level. On the 100-foot level, 200 feet of drifting and cross-cutting has been done and 175 feet on the 200-foot level.

The 40-stamp mill was nearly completed when it was destroyed by fire in July, 1911. Rebuilding was at once begun, and the new mill was completed in March, 1912. The superstructure of this mill, as well as of the power plant, is of structural steel and brick. The method of treatment of the ore is similar to that adopted in the mill destroyed. The mill was designed and erected by the Merrill Metallurgical Company. Preliminary crushing is accomplished by two gyratory crushers. The crushed ore is carried by belt conveyors to forty 1,250-pound stamps crushing to 8-mesh, and then passed over amalgamating plates to four Dorr classifiers. It is then reground in four tube mills and again passed over the amalgamating plates. The pulp is then conveyed to the concentration cones, three Dorr thickeners and four Pachuca agitators. From the tanks the product is passed through Dorr thickeners to Merrill slime presses. The gold in the solution will be precipitated by the Merrill zinc dust process. It is expected that the mill will have a capacity of 300 tons of ore per day. The machinery in the mill is motor-driven throughout.

The power plant consists of seven 150-h.p. Babcock & Wilcox boilers, four 300-k.w. generators (each driven by a Robb engine), a 12-drill compressor and double drum hoist.

Mr. A. Monel is president of the company and Mr. R. M. Meek general superintendent.

Dome Extension

The property, owned and operated by the Dome Extension Mines, Limited, is situated east of and adjoining the Dome mine. Captain Anchor is superintendent.

The shaft is 222 in depth with levels at 100 feet and 200 feet. On the first level a cross-cut has been driven north 90 feet and on the second level 250 feet. Drifts have been run east and west, on the second level, 180 feet and 130 feet respectively.

No. 4 shaft is 380 feet distant from No. 1 and is 100 feet in depth. At this depth a cross-cut was driven south 120 feet and 140 feet of drifting done.

The plant consists of two 80-h.p. boilers, an 8-drill compressor and hoist.

Dome Lake

The Dome Lake Mining Company are carrying on mining work on part of lot 6 in the first concession of Tisdale, under the supervision of Mr. J. F. McKenzie.

Two shafts have been sunk to depths of 60 feet and 50 feet, and 160 feet of drifting done in the former shaft and 30 feet in the latter.

The plant consists of a 25-h.p. boiler and hoist.

North Dome

On parts of lots 3 and 4 in the first concession of Tisdale the North Dome Mining Company are carrying on development work. Two shafts have been sunk to a depth of 60 feet each. At No. 1 shaft 250 feet of drifting has been done, and at No. 2 shaft 180 feet of drifting and cross-cutting.

The plant consists of an 80- and a 30-h.p. boiler, a 6-drill compressor and hoist.

Preston Dome East

The Preston East Dome Mining Company were carrying on work on both the Preston and the East Dome claims.

An incline shaft was sunk 50 feet and some drifting done.

The plant consists of a 30-h.p. boiler and hoist. Mr. S. Thorne was in charge of operations.

West Dome

The West Dome Mines, Limited, have been developing two claims to the west of and adjoining the Dome. Four shafts have been sunk. No. 1 shaft is 123 feet in depth with 204 feet of drifting on the 105-foot level. No. 2 shaft is 28 feet, No. 3 shaft 114 feet, and No. 4 shaft 76 feet deep.

The plant consists of two 60-h.p. boilers, a 6-drill compressor and hoist.

This company lost all their buildings and plant and nearly all their men in the Porcupine fire.

Foley-O'Brian

Work was carried on by the Foley-O'Brian Mining Company until July, 1911, when all work ceased. Two shafts were sunk to depths of 100 feet and 200 feet, and a few hundred feet of drifting done.

Gold Reef

The Porcupine Gold Reef Mining Company, Limited, with a capital of $1,000,000, were carrying on development work on parts of lots 9 and 10 in the fifth concession of Whitney. Two shafts have been sunk to depths of 25 feet and 38 feet.

Jupiter

The Jupiter Mines, Limited, have been developing a property on the north shore of Pearl lake. Mr. R. W. Brigstocke is manager, and Mr. J. H. Rattray superintendent.

No 1 shaft is 100 feet deep and connected with No. 1B shaft, 170 feet southwest, on this level. A cross-cut has also been driven north from the shaft 130 feet. No. 1B shaft is 200 feet in depth, and on this level 350 feet of drifting has been done. No. 2 shaft on the east side of the claim is 300 feet deep, and 125 feet of drifting has been done on both the 200-foot and 300-foot levels.

The plant consists of two 40-h.p. boilers, a 4-drill compressor and three hoists.

Hollinger

The Hollinger Mines, Limited, have an authorized capital of $3,000,000, divided into 600,000 shares of a par value of $5.00. Mr. Noah A. Timmins is president, Mr. D. A. Dunlap, secretary-treasurer, and Mr. P. A. Robbins, general manager.

The holdings of the company consist of four 40-acre claims comprising the east half of the north half and the northeast quarter of the south half of lot 11, and the northwest quarter of the south half of lot 10 in the second concession of Tisdale.

The company lost all their surface plant and buildings by fire on May 19th, 1911. This included the 30-stamp mill which was partly erected. A 4-compartment shaft has been sunk on claim 13,156 to the 200-foot level. All the ore will be trammed underground to this shaft and hoisted to the crusher station located at the collar of the shaft. This crusher station will consist of a gyratory crusher, revolving screen and fine jaw crusher. The ore will be conveyed from here to the top of the mill by belt conveyor.

The manager reports the total underground work done to December 31st, 1911, to be as follows:—

Shafts	366	feet.
Winzes	127	"
Raises	82	"
Drifts, 100-foot level	1,289	"
Drifts, 200-foot level	370	"
Cross-cuts, 100-foot level	1,233	"
Cross-cuts, 200-foot level	250	"
Total	3,717	"

The power plant consists of a 15-drill compressor electrically driven, and a double drum electric hoist. New shops, change house for the underground men, assay office and transformer station have been erected. The sleep camps and boarding house are being erected in the town of Timmins.

The process as decided for treatment of the ore is as follows:—

1. Coarse grinding.
2. Stamping in cyanide solution.
3. Tube milling.
4. Concentration followed by amalgamation of concentrates.
5. Cyanide treatment of both gangue and concentrate residues.

The apparatus being installed in the mill is as follows:—

1 Gyratory crusher.
1 jaw crusher.
Sampling plant.
40- 1,500-pound stamps.
4 Dorr classifiers.
4 Spitzkasten.
40 Deister slime tables.
4 Dorr pulp thickeners.
4 Trent agitators.
2 Moore filters.
2 Merrill clarifying presses.
2 Merrill precipitation presses.
4 Tube mills.
Pumps, amalgamating pans and settlers.

The mill will be motor-driven throughout, power being obtained from the Porcupine Power Company.

Hollinger Reserve

The Hollinger Reserve Mining Company were engaged the latter part of the year in diamond drilling on claims Nos. 44, 45 and 46 in the township of Ogden under the supervision of Mr. W. Evans.

Hughes

On parts of lot 10 in the fourth concession of Whitney the Hughes Porcupine Mines, Limited, were carrying on development work. A shaft 50 feet in depth has been sunk, and a cross-cut 45 feet in length driven.

The plant consists of a 25-h.p. boiler and a hoist.

Imperial

On mining claims H.R. 950 and 951 in the township of Deloro, the Imperial Gold Mining Company, Limited, were carrying on development work during part of 1911. A shaft has been sunk a depth of 100 feet and a 150-foot cross-cut driven.

The plant consists of a 60-h.p. boiler and hoist.

Iroquois

On parts of lot 9 in the first concession of Whitney the Iroquois Porcupine Mining Company were engaged in prospecting and development work. Two shafts were sunk to depths of 40 and 25 feet.

The plant consists of a 30-h.p. boiler and hoist.

La Palme

The La Palme Mining Company did some work on parts of lots 4 and 5 in the fifth concession of Whitney. A shaft was sunk a depth of 45 feet.

Little Pet

On mining claim H. R. 907 in the township of Deloro, the Little Pet Mining Company have sunk a shaft to a depth of 95 feet and done about 100 feet of drifting. The plant consists of two 60-h.p. boilers, a 7-drill compressor and hoist.

Moneta

On parts of lot 12 in the first and second concessions of Tisdale the Moneta Mines, Limited, have been diamond-drilling and shaft-sinking. The shaft is sunk to a depth of 100 feet.

The plant consists of a 6-drill compressor driven by a 100-h.p. motor and two hoists.

McEnaney

The Crown Reserve Mining Company have been carrying on development work on the McEnaney claim, which adjoins the Hollinger on the south. No. 1 shaft has been sunk 60 feet, No. 2 shaft 300 feet with 70 feet of cross-cutting on the 100-foot level and 140 feet of drifting on the 200-foot level. No. 3 shaft is 100 feet deep with 80 feet of drifting, and No. 4 shaft 100 feet deep with 240 feet of drifting.

The plant consists of a motor-driven compressor and hoists.

McIntyre

The McIntyre Porcupine Mines, Limited, have carried on extensive development work on a 40-acre claim at the west end of Pearl lake. No. 1 shaft on the southwest corner of the claim has been sunk 200 feet, with levels at 100 feet and 200 feet. On tne first level 140 feet of drifting and 140 feet of cross-cutting was done, and on the second level 320 feet of drifting and 340 feet of cross-cutting. No. 4 shaft, near the southeast corner of the claim, is 200 feet deep, with 250 feet of drifting and 120 feet of cross-cutting at the 200-foot level. No. 2 shaft on the west side of the claim is 75 feet deep, with 170 feet of drifting and cross-cutting at the level. No. 5 shaft, 360 feet east of No. 2, is 200 feet deep with 100 feet of drifting at the lower level. No. 3 shaft, near the north side of the claim, is 75 feet deep with 150 feet of drifting and 75 feet of cross-cutting. A 10-stamp mill has been erected near No. 1 shaft and milling was commenced in February, 1912. The ore is first put through a crusher, then goes to stamps and is passed over amalgamating plates. It is then concentrated, the concentrates being stored for further treatment.

The power plant consists of three 60-h.p. boilers, a 12-drill compressor, built for operating by steam or motor, and hoists at each of the shafts.

Mulholland

On part of lot 10 in the fifth concession of Whitney the Mulholland Mines, Limited, have been carrying on development work under the supervision of Mr. D. Allen.

A shaft has been sunk to a depth of 100 feet and 285 feet of drifting and 140 feet of cross-cutting done at the above depth. The plant consists of a 25-h.p. boiler and hoist.

Ontario Porcupine

On claim No. 13,042, consisting of the southeast quarter of the south half of lot 8 in the third concession of Tisdale, east of Pearl lake, the Ontario Porcupine Goldfields Development Company, Limited, have sunk a shaft to the depth of 150 feet. Cross-cuts were run north 430 feet and south 275 feet at the 150-foot level. On this claim a plant was erected consisting of two 60-h.p. boilers, 6-drill compressor and hoist.

Pearl Lake

The Pearl Lake Gold Mines, Limited, have during the year carried on mining work on the east half of the south half of lot 10 in the third concession and on the north half of the south half of lot 9 in the third concession of Tisdale. Most of the work has been done on the south 40 acres of lot 10 to the north of Pearl lake. No. 2 shaft has been sunk 50 feet and No. B shaft 100 feet with 200 feet of drifting at the 100-foot level. A main 3-compartment shaft is being sunk and has reached a depth of 400 feet.

The power plant consists of a 12-drill compressor, electrically driven, and a double drum hoist.

Plenaurum

The Plenaurum Mines, Limited, have taken over the Armstrong-Booth claims, consisting of the west half and northeast quarter of the south half of lot 8, the north half of the south half of lot 7, and the west half of the south half of lot 6 in the third concession of Tisdale. Two shafts have been sunk on the southwest quarter of the south half of lot 8 to a depth of 200 feet each. A drift has been run north from No. 1 shaft 325 feet, south 75 feet, and east 140 feet. From No. 2 shaft a drift has been run northwest towards No. 1 shaft 250 feet.

The power plant consists of a 9-drill compressor, electrically driven, and two hoists. Mr. C. E. Watson is manager.

Rea

The Rea Consolidated Gold Mines, Limited, carried on mining work on the south half of lots 5 and 6 in the fourth concession of Tisdale. The main shaft has been sunk 400 feet with levels opened up at 200 feet, 300 feet and 400 feet. On the 200-foot level drifts have been run northeast 125 feet and southwest 260 feet. From the southwest drift a cross-cut was run northwest 275 feet. The Eakin shaft, 130 feet west of the main shaft, connects with this level. On the 300-foot level drifts have been run northeast 120 feet and southwest 110 feet and a cross-cut driven northwest 80 feet. On the 400-foot level a cross-cut was run northwest 80 feet and considerable diamond drilling done.

The plant consists of two 60-h.p. boilers, a 6-drill compressor and hoist.

Scottish Ontario

On the southeast quarter of the south half of lot 11 in the fifth concession of Whitney the Scottish Ontario Gold Mining Company have sunk a shaft a depth of 90 feet. On the 80-foot level the cross-cut has been driven 160 feet and 260 feet of drifting done on a vein encountered 50 feet north of the shaft.

Smith Veteran

Under superintendent D. Allen the Smith Veteran Mines, Limited have been carrying on development work. A shaft was sunk 55 feet and 40 feet of drifting and 124 feet of cross-cutting done at this level.

The plant consists of a 25-h.p. boiler and hoist.

Standard

On claims H. R. 908 and M. E. 15 in the township of Deloro the Standard Gold Mines, Limited, have been carrying on development work. One shaft has been sunk 83 feet and 40 feet of a cross-cut driven. Some diamond drilling has also been done.

The plant consists of a 20-h.p. boiler and hoist.

Three Nations

Near Three Nations lake on lot 5 in the fifth concession of Whitney the Three Nations Gold Mining Company have been carrying on prospecting work. Considerable stripping has been done and a shaft sunk 37 feet.

Vipond

The Vipond Porcupine Mines Company Limited have been developing the southeast quarter of the south half of lot 10 in the second concession and the northeast quarter of the north half of lot 10 in the first cocession of Tisdale. The main shaft has been sunk a depth of 200 feet with levels at 100 feet and 200 feet. On the first level 380 feet of drifting has been done on the main vein and about 250 feet of cross-cuttng. On the second level a cross-cut has been driven northwest from the shaft 80 feet and southeast 120 feet. On the vein 170 feet of drifting has been done.

An new plant has been installed, consisting of a 9-drill compressor driven by a 150-h.p. motor and hoist.

The test mill was destroyed by the Porcupine fire. A new mill of about 100-ton capacity per day is being erected and is expected to be completed by July 1st, 1912.

Mr. C. H. Poirier is manager.

IV.—EASTERN ONTARIO

But little change was noted in the mining industry in Eastern Ontario during the last year. About the same number of properties were being worked, yielding practically the same production. Work was resumed at the Cordova gold mine in Peterborough county after having been closed for eight years. The Mayo iron mine at Bessemer was reopened by the Canada Iron Mines, Limited, who are building a concentrator at Trenton for treating ore from the Mayo, Coe Hill and Blairton mines.

A mill for the grinding of feldspar was erected one and a half miles from Parham Station, Kingston and Pembroke railway, by the Suroff Feldspar Mining and Milling Company, the feldspar to be obtained from the company's properties on Bob's lake. Shipments of crude feldspar to the United States from the Richardson mine continued steadily throughout the year.

Other minerals produced were corundum, iron pyrites, mica, graphite, talc and zinc. The production of marble, building stone, crushed stone and limestone for the manufacture of cement shows an increase.

Iron

Ledyard Mine

The Buffalo Union Furnace Company, with head office in Buffalo, started work on the Ledyard mine on lot 19 in the first concession of Belmont in the county of Peterborough, the latter part of the year, and a shaft was sunk a depth of 100 feet. A plant consisting of two boilers of a capacity of 80-h.p. and 45-h.p., a small straight line compressor and hoist, has been erected.

Mr. Frank Platto is superintendent, employing 20 workmen.

Mayo

The Mayo mine at Bessemer, formerly owned by the Mineral Range Iron Mining Company, and closed down since May, 1910, has been taken over by the Canada Iron Mines, Limited, and work was begun in April, 1912.

The old No. 4 workings have been unwatered. The shaft is being sunk and drifting done on the 110-foot level.

A new plant, consisting of two 150-h.p. boilers, a 20-drill compressor and double-drum hoist, has been installed.

Orton

Work was begun early in 1912 on the Orton mine in Hastings county. The work being done consists of stripping, trenching and test-pitting.

Wilbur

The Exploration Syndicate of America ceased all work at the Wilbur mine in August, 1911. Stoping had been carried on in the No. 1 shaft and the upper part of the ore body open-cut. Another shaft northeast of No. 1 was re-opened and timbered to a depth of 80 feet, where drifts were run north and south distances of 100 feet respectively.

Cordova Gold Mine

The old Belmont mine was re-opened in 1911, after being closed for eight years, and is being worked by the Cordova Mines, Limited. Nos. 1, 3, and 7 shafts have been pumped out and work begun. No. 1 shaft is 400 feet deep with levels at 60 feet, 100 feet, 200 feet, 300 feet and 400 feet. Most of the work was formerly done on the 300-foot and 400-foot levels, where 450 feet and 550 feet of drifting were done respectively in addition to the stoping. No. 3 shaft is 440 feet in depth with levels at 85 feet, 185 feet, 285 feet, and 385 feet. Considerable stoping was done above the third level and on the fourth level 400 feet of drifting. The new work is being confined to the fourth level. No. 7 shaft is 135 feet deep with level at 85 feet. Some new work has been done on this level.

The 30-stamp mill on the property has been renovated and put in operation.

Mr. P. Kirkegaard is managing director.

Iron Pyrites

Sulphide

The main shaft at this mine is now down to the sixth level, a depth of 575 feet. Mining work is being carried on at the first, fourth and sixth levels. On the first level, north vein, stoping is being done. On the fourth level 300 feet of drifting has been done on the south vein, a cross-cut driven to the north vein 120 feet and 360 feet of drifts run on the north vein. A raise has also been put through to the third level on this vein and stoping begun. On the fifth level 180 feet of drifting has been done on the south vein, 225 feet on the north vein, and connected by a cross-cut 120 feet in length. On the sixth level a drift was run east 75 feet from the shaft and a cross-cut driven to the north vein, where 75 feet of drifting has also been done.

At the acid plant additional machinery is being installed for crushing the ore. The new units of the plant have been completed, and sulphuric, nitric and hydrochloric acids are produced.

Mr. W. H. DuBlois is superintendent for the owners, the Nichols Chemical Company.

Craig

On the Craig property, situated about one-half mile west of the Sulphide mine, the shaft has been sunk a depth of 300 feet, following the dip of the ore. Stoping has been carried on at both the 100-foot and 200-foot levels. On the 200-foot level drifts have been run east 100 feet and west 50 feet. East of the shaft on this level the ore body has been opened up for a width of about 30 feet and a raise started. A raise for the purpose of ventilation from the first level to the surface has been begun.

The plant and equipment remain the same as described in the last Report of the Bureau of Mines.

Queensboro

Work has been carried on continuously by the Canadian Sulphur Ore Company on the northeast quarter of lot 9 in the tenth concession of Madoc. The main shaft is 180 feet deep, but no work is being done in it. Another shaft about 400 feet distant is 100 feet deep, with drifts run east 25 feet and west 80 feet. This shaft was sunk on the ore body, and the ore is being mined by open-cut methods. The company purpose building an aerial tramway from the mine to the railroad two miles distant.

Mr. John Harris is superintendent, employing 30 men. Thirty tons of ore per day are being shipped.

Olden Zinc

The Olden zinc mine, owned by Messrs. Richardson, of Kingston, was worked part of the year under superintendent S. Hunter. The shaft on the vein northwest of the old workings was sunk to a depth of 150 feet, and a new shaft east of the old power house sunk 50 feet. A new plant was installed, consisting of two 100-h.p. boilers and a 14-drill compressor.

Feldspar

Richardson Mine

This mine, owned and operated by the Kingston Feldspar and Mining Company, is still the largest shipper of feldspar in the Province. The feldspar is mined by open-cut work, and the only change recorded during the year was the enlarging of the area of the workings, there being no increase in the depth. Considerable capping of gneiss is being removed from both the northeast and northwest sides of the deposit. This will make accessible a large body of feldspar. A large tonnage of quartz in the central part of the deposit was also removed. The system of transportation from the mine to the railway remains the same, with the exception of the enlargement of the scows on the lakes.

Mr. M. J. Flynn is superintendent, employing 50 men.

Reynolds

The Kingston Feldspar and Mining Company began work on lot 1 in the thirteenth concession of Portland township in 1911. The feldspar mined was taken from an open pit 60 feet long, 30 feet wide by 10 feet deep. A 20-h.p. boiler and hoist are used and 16 men employed.

Card

This mine is also operated by the Kingston Feldspar and Mining Company, and the feldspar has been mined from an open pit 250 feet long, 25 feet wide and 25 feet deep. A cable haulage-way was erected the latter part of the year and a new double drum hoist for operating buckets on it.

Suroff

The Suroff Feldspar Mining and Milling Company have constructed a mill for the grinding of feldspar one and a-half miles from Parham station on the Kingston and Pembroke railway. Some work was also done on the company's mining properties on Bob's lake.

Mr. A. Morton is the mill superintendent.

Talc

Henderson Mine

This mine is being operated under lease by Mr. S. Wellington, who employs 15 men. The main shaft has been sunk a depth of 185 feet, with levels at 120 feet and 185 feet. On the 120-foot level a drift has been run east 400 feet, and the ore body open-cut for a length of 150 feet to the level. All mining work is now confined to the 185-foot level, where a drift has been run east 300 feet. This level is being worked by the square set method. In beginning this system on the level a line is chosen at right angles to the longitudinal axis of the deposit, and a room driven across the deposit the width of one set of timbers and the square sets put in. A slice is then taken across the deposit on top of these sets and another set of timbers put in. This is carried through to within 20 feet of the level above and another slice taken alongside of the first row of sets, the talc extracted and square sets put in place as in the first set. Care is taken to put in the set as soon as there is space for it. The greater part of the ore is sold to Geo. H. Gillespie and Company, who operate a mill for grinding talc at the railway station, Madoc.

Gillespie Mill

This mill, owned and operated by Geo. H. Gillespie and Company, was run continuously throughout the year. The mill was enlarged the latter part of the year to a capacity of from 25 to 30 tons per day.

Canadian Talc and Silicate Company

This company have opened up a mine and built a mill for the grinding of talc about two miles north of Eldorado, in the county of Hastings. A shaft has been sunk 75 feet and a drift run east 100 feet. A mill with a capacity of about five tons per day has been erected.

A power plant consisting of a 70-h.p. boiler, engine for driving mill machinery and hoist, has been installed.

Mr. C. J. Jones is president of the company, and R. M. Phillips superintendent. The company's head office is at the McKinnon Building, Toronto.

Mica

There was a decrease in the production of mica during 1911 compared with the preceding year. The prices were very good, but no new properties of importance were opened up.

Lacey

This mine, owned by the Loughborough Mining Company, continues to be the main producer of mica in the Province. Operations have been carried on continuously in the main workings since 1900. Prior to that considerable work was done in a pit about 300 feet distant from the present workings.

During the summer months all work is confined to the open cut, which has now reached a depth of 90 feet, with an area at the surface of 75 feet by 100 feet. Work is carried on during the winter on a parallel body about 100 feet south of main workings and at a depth of 140 feet. This stope has been enlarged and drifts extended an additional 50 feet to the northeast.

Mr. G. W. McNaughton is manager.

Bob's Lake

On the west side of Bob's lake, in Frontenac county, Messrs. Stoness and Kent carried on mining operations during the year. The mica is mainly produced by open-cutting the veins to depths from 50 to 75 feet. The mica is shipped to Kingston, where it is cleaned and thin-split.

Birch Lake Syndicate

Near Birch lake, Loughborough township, the Birch Lake Syndicate, of which Mr. A. Martin is manager, have been prospecting for mica. Several test pits have been sunk up to 40 feet in depth and some mica produced.

Silver Queen

On lot 13 in the fifth concession of Burgess township Mr. Edward Smith has continued operations. The old workings have been abandoned and several test pits sunk up to 30 feet in depth on different parts of the property.

Some shipments of feldspar were also made from the same property.

Other Mica Properties

Mr. G. E. Allard has been prospecting for mica in the township of Loughborough. Mr. J. A. Stewart, of Perth, also did some prospecting on the northwest side of Otty lake.

Mica Trimming Works

The same firms are engaged in trimming and thin-splitting mica in Ottawa, as reported last year, namely: General Electric Company; Laurentide Mica Company; Eugene Munsell & Company; Wallingford Mining & Mica Company; Mr. R. Blackburn; Mr. S. O. Filion; Mr. N. Holland; and in Kingston, Kent Bros.

Graphite

Black Donald

The Black Donald Graphite Company operated their mill all year, and the mine during the summer months, when sufficient crude material was produced for the year's operation of the mill. The heading in the open pit was advanced 25 feet and the pit timbered. The refined graphite is hauled to Calabogie, a distance of 12 miles, for shipment.

Mr. R. F. Bunting is manager, and Mr. Geo. W. Stewart superintendent.

McConnell

The mill at Port Elmsley and the mine three miles distant, owned by the Globe Refining Company, were worked until August, 1911, when operations were suspended. The shaft at the mine was then 90 feet deep, with drifts east 125 feet and west 100 feet from the shaft.

Wilberforce

The Virginia Graphite Company completed their mill at Wilberforce. Some graphite was mined from their quarry near the mill and a quantity shipped from a property near Maynooth on the Central Ontario railway. The equipment of the mill consists of two 125-h.p. boilers, an 18 by 48-inch Corliss engine, a crusher, rolls, screens, and nine separators. The concentration is by a dry process.

Mr. H. G. Tonkin is manager.

Manufacturers' Corundum Mines

The Manufacturers' Corundum Company continue to operate the mine and mills of the Canada Corundum Company and the Ashland Emery and Corundum Company. The same system of working both the mines and mills is followed as described in former Reports of the Bureau of Mines. All the mining is still done by open-cut work, and these open cuts have been deepened and enlarged and new pits opened.

Mr. D. A. Brebner is managing director.

Deloro Silver Refinery

The Deloro Mining & Reduction Company, with works at Deloro two miles from Marmora station, Central Ontario railway, continued the work of smelting cobalt-silver ores throughout the year. The freight rates from Cobalt to Marmora station on ore have a value of:—

1. Under $50 per ton	$5.60
2. $50 and under $100 per ton	6.80
3. $100 and under $500 per ton	8.20
4. $500 and over per ton	9.60

The schedule of payment for the ores f.o.b. Marmora station is as follows:—The company pay for the best assay value of the ore, less a smelting charge of $25 per ton and a refining charge of (1) ¾ of a cent per ounce of silver contents on ore assaying 3,000 ounces and over per ton; (2) 1 cent per ounce of silver contents on ore assaying from 2,000 to 3,000 ounces per ton; and (3) 1½ cents per ounce of silver contents on ore assaying less than 2,000 ounces per ton. Payment is made for 75 per cent. of the net proceeds, according to Messrs. Handy & Harman's New York quotation, 30 days after completion of sampling, and the balance in 90 days according to the same company's quotation on that date.

Mr. S. B. Wright is manager.

Limestone Quarries

Lehigh

The Canada Cement Company quarry limestone at Point Anne, six miles from Belleville, for use in manufacturing cement at their Lehigh and Belleville plants. The quarry has a depth of 30 feet and an area of 700 feet by 350 feet. A steam shovel is used in the quarry for loading the broken rock. A spur was built from the quarry, which adjoins the Lehigh plant, to the Belleville plant for hauling the limestone. A hoisting and loading station was also erected. The company employ 50 men in the quarry.

Point Anne

The Point Anne Quarries, Limited, were engaged during the whole of the season of navigation in mining, crushing and shipping limestone. The quarry is located between the Lehigh and Belleville plants of the Canada Cement Company. It is still very shallow, and the rock when broken is loaded by a steam shovel into cars, which are hauled by horses to the crushing plant, where the rock is crushed and graded.

Mr. A. G. Bennett is superintendent, employing 50 men.

Burnt River

Britnell and Company, of Toronto, continued to work their quarry near Burnt River, in the township of Somerville, during the summer months. Building stone and crushed rock are shipped to Toronto.

Preneveau

About five miles east of Havelock the Ontario Rock Company are opening up a quarry of diabase. The rock is to be used in the macadamizing of roads. A crushing plant is being erected, and a spur from the Canadian Pacific railway built.

Brick Works

Don Valley

At the Don Valley Brick Works, situated in the valley of the Don river, just outside of Toronto, both clay and shale are quarried and used in the manufacture of brick. The clay overlies the shale and has a thickness of about 50 feet. The shale quarry is 35 feet in depth and 150 feet in diameter, the pit being circular in area. The clay is loaded into cars by a steam shovel.

Mr. Robt. Davies is manager, employing 30 men in the quarry.

Other Brick Works

The following companies are engaged in excavating clay for the manufacture of brick in the eastern part of the City of Toronto:—

A. H. Wagstaff & Company, 362 Greenwood Avenue.
Bell Bros. & Company, 368 Greenwood Avenue.

Isaac Price, Greenwood Avenue.
Standard Brick Company, Greenwood Avenue.
J. Logan, 473 Greenwood Avenue.
Ashbridge Brick Company, Greenwood Avenue.
Morley Walker, Greenwood Avenue.
Morley & Ashbridge, Greenwood Avenue.
John Price, Greenwood Avenue.
Thos. Sawden, Leslie Street.
Jos. Russell, Greenwood and Blake Avenues.

Deseronto Blast Furnace

The Standard Iron Company have been operating a charcoal furnace at Deseronto. About 60 tons of pig iron are produced per day and 60 men employed.

Major Peuchen, of Toronto, is president, and Mr. R. H. Watson superintendent.

V.—SOUTHWESTERN ONTARIO

This area, although mainly agricultural in character, contributes largely to the mineral wealth of the Province. The occurrence here of oil, natural gas and salt has created large industries. A considerable number of industries located here owe their success to the accessibility of mineral deposits. The abundance of cheap electric power has been an inducement to locate in this area to those companies who derive their material from other places, such as the Coniagas Reduction Company, Thorold, the Canada Refining & Smelting Company, Orillia, and others. The mining of gypsum in the valley of the Grand river, and the quarrying of limestone for the manufacture of cement, lime and building stone are all important industries.

Canada Refining and Smelting Company

The Canada Refining and Smelting Company, with works at Orillia, are engaged in the treatment of cobalt-silver ores. The capacity of the plant has been doubled during the year, and is now about 300 tons per month. The company produce refined silver, white arsenic (As_2O_3), and cobalt and nickel hydrates.

The freight rate from Cobalt to Orillia on ore having a value of:—

1. Under $50 per ton is $4.20 per ton.
2. $50 and under $100 per ton is $5.40 per ton.
3. $100 and under $500 per ton is $6.20 per ton.
4. $500 and over per ton is $7 per ton.

The schedule of payments by the company for the ores f.o.b. Orillia, according to commercial assay, is as follows:—

84	per cent. of	silver	when	same assays	200	oz. and over	per ton.
86	"	"	"	"	300	"	"
89	"	"	"	"	500	"	"
91	"	"	"	"	750	"	"
93	"	"	"	"	1,000	"	"
93½	"	"	"	"	1,500	"	"
94½	"	"	"	"	2,000	"	"
95	"	"	"	"	2,500	"	"

less a refining charge of (1) ½ cent per oz. on ores containing less than 3,000 oz. per ton; (2) ¾ cent per oz. on ores containing less than 1,500 oz. per ton; and (3) a smelting charge of $10 per ton in addition on ores containing less than 1,000 oz. per ton.

Payment is made according to New York official quotation for 75 per cent. of amount 30 days after sampling report, and the balance in 90 days according to the same quotation on that date.

Mr. W. F. Almy is manager.

Coniagas Reduction Company

The Coniagas Reduction Company at Thorold produce refined silver, arsenic, and cobalt and nickel oxide from the cobalt-silver ores of Cobalt.

The freight rate from Cobalt to Thorold on ore having a value of

1. Under $50.00 per ton is $4.80 per ton.
2. $50.00 and under $100.00 per ton is $6.00 per ton.
3. $100.00 and under $500.00 per ton is $7.00 per ton.
4. $500.00 and over per ton is $8.00 per ton.

The schedule of payment by the company for the ores f.o.b. Thorold according to commercial assay is as follows:—

55	per cent. for	50 oz. and	proportionate	increase in	percentage up to
73	"	200 oz.	"	"	"
78	"	300 oz.	"	"	"
84	"	500 oz.	"	"	"
91½	"	1,000 oz.	"	"	"
92½	"	1,500 oz.	"	"	"
93½	"	2,000 oz.	"	"	"
95	"	3,000 oz. and over.			

Payment is made according to Messrs. Handy and Harman's New York quotation for 75 per cent. of amount 30 days after sampling report, and the balance in 90 days according to the same company's quotation on that date. The sampling charges are to be paid by the vendor.

Mr. R. L. Peek is superintendent.

Blast Furnaces

Hamilton

The Steel Company of Canada, successors to the Hamilton Steel and Iron Company, have two furnaces in blast at Hamilton, and produce about 500 tons of pig iron per 24 hours. Most of the iron ore used is obtained from Michigan and Minnesota.

Mr. R. Hobson is president, and Mr. H. H. Champ treasurer.

Canada Iron Corporation

The blast furnace of the Canada Iron Corporation at Midland has been in blast all year, and has produced from 200 to 300 tons of pig iron per day. Most of the ore used is obtained from the mines of Michigan and Minnesota. Limestone for flux is obtained from the company's quarry in the township of Tay, Simcoe county.

Gypsum

The Alabastine Company and the Crown Gypsum Company have been mining gypsum in the vicinity of Caledonia during the year. Both companies have mills for grinding. The lower grades of material are used in the cement industry, and the higher grades in the manufacture of alabastine, stucco and ornamental work.

The Alabastine Company

This company's mine is situated about three-eighths of a mile north of the town of Caledonia on lot 10 of the first range west of the Hamilton and Port Dover Road in the township of Seneca. The body of gypsum being mined occurs at a depth of 80 feet and the material is hoisted through the incline shaft. An air shaft, in which is the ladderway for the men, is 725 feet northwest of the mouth of the incline shaft. The mine is worked by the room and pillar method. In the new workings a regular plan is followed, a pillar 10 feet in width being left between each of the rooms, which are 18 feet wide. The workings now extend over an area of 300 feet by 300 feet.

The mill is situated about 75 feet from the mouth of the incline shaft. The gypsum is crushed, calcined, and prepared for shipment.

Carson

The Alabastine Company also work the Carson mine, about three miles south of Caledonia, for white gypsum. This mine is operated by incline shaft, and the distance from the mouth of the incline to the working face is 750 feet. The system of mining being used here is similar to that in the mine worked by the company at Caledonia, except that the waste is used for filling the worked-out rooms.

Crown Gypsum Company

This mine, situated one-half mile from York, on the south side of the Grand river, in Oneida township, was worked during the year. The same system of mining is followed as already described, the only difference in the underground workings from year to year being the increase in the area worked out. This mine produces a white gypsum of good grade.

The product is shipped by the company's narrow-guage railway to Lythmore station, Michigan Central railway, where the mill for grinding is located.

Zinc

On lot 31 in the third concession east, township of Albermarle, Bruce county, five miles northwest of Wiarton, the Albermarle Zinc Company did some prospecting. Several test pits were sunk to depths of from 5 to 20 feet. The zinc occurs as blende in Guelph limestone.

Quarries

There are many quarries in this part of Ontario which operate only during the summer months. The larger quarries were inspected, but a number of the smaller ones, on account of being worked so short a time, were not visited. There is as a rule considerable carelessness shown at quarries, particularly in the handling of explosives. Proper magazines are not provided for the storage of explosives, and there is a lack of safe and efficient thawing houses. It has been observed that where properties are not worked continuously there is frequently a lack of care in safeguarding employees. The provisions of the Mining Act for the protection of workmen apply equally to the quarries as well as to the mines, and must be observed.

Port Credit

At the works of the Port Credit Brick Company shale is employed in the manufacture of brick. This quarry is a large open pit, with walls about 15 feet in height and about 400 feet in diameter. The broken shale is loaded into cars by means of a steam shovel.

Battle's Quarry

Near Thorold, Joseph Battle operates a limestone quarry. The plant consists of a 60-h.p. boiler, crusher and screens. A force of 40 men are employed.

Cartmell

One and a half miles west of Thorold, Mr. Wm. Cartmell had a force of six men employed in a quarry. His plant consists of a 12-h.p. boiler, hoist and derrick.

Christie, Henderson and Company,

On the east half of lot 4 in the fifth concession of Nassagaweya township, county of Halton, a limestone quarry is being worked by Christie, Henderson and Company. The rock is used both for building stone and concrete work. A 14-h.p. boiler supplies steam for the crushing plant.

Clifton Sand, Gravel and Construction Company

This company are engaged chiefly in the excavation of sand and gravel. The pit is located at Stamford.

Hagersville

The Hagersville Contracting Company's limestone quarry on lot 14 in the thirteenth concession of Walpole township, Haldimand county, was worked last year. The material produced is used largely as a flux and in road-building. A crushing plant has been erected with crushers and screens.

Mr. D. C. Ingles is manager, employing 60 men.

Doolittle and Wilcox

Doolittle and Wilcox, Limited, operate a quarry for the production of crushed limestone on lots 11 to 14 in the first concession of the township of West Flamboro, near Dundas. The quarry is on the top of a hill and the crushing plant on the side, discharging into bins over the railway siding. The quarry has a length of 800 feet by 400 feet in width by about 18 feet in depth. The broken rock is loaded into cars by a steam shovel. These cars are hauled by locomotives to the crushing plant. The rock passes through one large and three small crushers, is screened, and carried by conveyor belt to the bins. All the crushers are driven by electricity.

Mr. Jas. D. Small is superintendent, employing 100 men.

Empire Limestone Company

At Sherkston, in the township of Humberstone, the Empire Limestone Company operate a limestone quarry.

The plant consists of a 150-h.p. boiler, compressor, 5 locomotives, 4 steam shovels and a crushing plant.

The quarry is worked as a large open pit, the limestone being loaded by steam shovels into cars, which are hauled by the company's locomotives to the crushing plant and then loaded on railway cars for shipment. Work is carried on during all the year and 160 men are employed.

Grantham

On lot 15 in the tenth concession of Grantham the Grantham Stone Quarries are being worked part of the year, by Mr. H. C. Ball, with a small force of men.

The company have a small plant, consisting of a 20-h.p. boiler and an engine for driving the crusher.

Michigan Central

At Hagersville the Michigan Central Railway Company operate a limestone quarry for part of the year. No work was being done when inspected in 1911.

The plant consists of two 150-h.p. boilers, a 6-drill compressor and crushers.

Power City

The Power City Stone Company operate a quarry of limestone at St. Davids, employing 30 men.

The plant consists of two 20-h.p. boilers, three electric motors, one Gates crusher and an electric motor for hauling rock from the quarry to the crusher.

Queenston

At St. Davids the Queenston Quarry Company, Limited, employ 50 men in operating a limestone quarry. Most of the rock quarried is crushed and used in concrete work or for road metal.

The plant consists of two 24-h.p. boilers, a 3-drill compressor and crusher.

Robertson

On lot 7 in the fourth concession of the township of Nassagaweya, D. Robertson Company, Limited, are quarrying limestone to be used for the manufacture of lime. The company have three lime kilns and employ 50 workmen.

Standard

At Beachville the Standard White Lime Company quarry limestone for the manufacture of lime. The company have five lime kilns and employ 40 workmen.

St. Mary's

At St. Mary's limestone is being quarried at the St. Mary's Horse Shoe quarry for use in concrete work.

The plant consists of two boilers of 25-h.p. and 100-h.p. capacity respectively. Steam drills are used in drilling, and the rock is crushed by a No. 6 Austin crusher and two No. 3 Gates crushers. A 125-h.p. engine operates the crushing machinery.

Toronto Lime Company

At Limehouse on lot 22 in the fifth concession of Esquesing, the Toronto Lime Company are quarrying limestone for the manufacture of lime.

Thames Quarry Company

The Thames Quarry Company quarry limestone at St. Mary's, for use chiefly in concrete work and road material. Electric power is used for operating the two crushers and for hoisting.

Wentworth

At Vinemount on lot 4, in the fifth concession of Saltfleet, the Wentworth Quarry Company, Limited, are quarrying limestone for use as building material and for concrete work and road metal.

The plant consists of a 25-h.p. boiler, gas engine and crushers. A steam shovel is used for loading the broken rock into cars, which are hauled to the mill for crushing.

Walker

On lots 31 and 32, Thorold town line, township of Stanford, Messrs. Walker Bros. employ eight workmen in the quarrying of limestone. The rock is used chiefly for building material.

Oliver and Webster

Messrs. Oliver and Webster operate a limestone quarry on the east side of the town of Owen Sound, and ship both building and crushed stone, the former chiefly to Toronto. The quarries are from 12 to 20 feet deep, and the one at present being worked is over an acre in area. Derricks and horse whims are used for hoisting the material. The crushing plant consists of a gyratory crusher, elevator, trommels and bins. Power is obtained from two small boilers, which are being replaced by electricity.

Hazelton

Adjoining the quarry of Messrs. Oliver and Webster, Owen Sound, Mr. Chas. Hazelton is engaged in quarrying limestone for building stone, which is shipped chiefly to Toronto. The quarry is from 15 to 20 feet in depth. The limestone occurs in beds from 3 to 6 inches thick.

Brown

Mr. Oliver Brown operates a quarry and lime kiln to the west of the town of Owen Sound. The quarry walls are not more than 10 to 15 feet high, and the rock is hauled by carts and dumped into the kiln. Wood is used for firing.

Chalmers

South of Brown's lime kiln, on the west side of Owen Sound, Mr. D. Chalmers operates a quarry and lime kiln. The kiln is about 200 yards from the quarry and on the hillside. The broken limestone is hauled in carts and dumped into the mouth of the kiln.

GOLDFIELDS OF LAKE OF THE WOODS, MANITOU AND DRYDEN

By Arthur L. Parsons

Introduction

In accordance with instructions received from Mr. T. W. Gibson, Deputy Minister of Mines, the writer left Toronto on May 19th, 1911, to continue the examination of the gold fields in the vicinity of Lake of the Woods, Manitou lake, Eagle lake and Dryden. The work done in the summer of 1910 consisted of a general review of the geological formations in this region, with an examination of such mines as were accessible, and detailed work in small areas near the more important mines. During the past season special attention was paid to a study of the rocks more immediately connected with the gold deposits, to ascertain whether any conclusions could be drawn which would show a definite relation between the ore bodies and some particular rock.

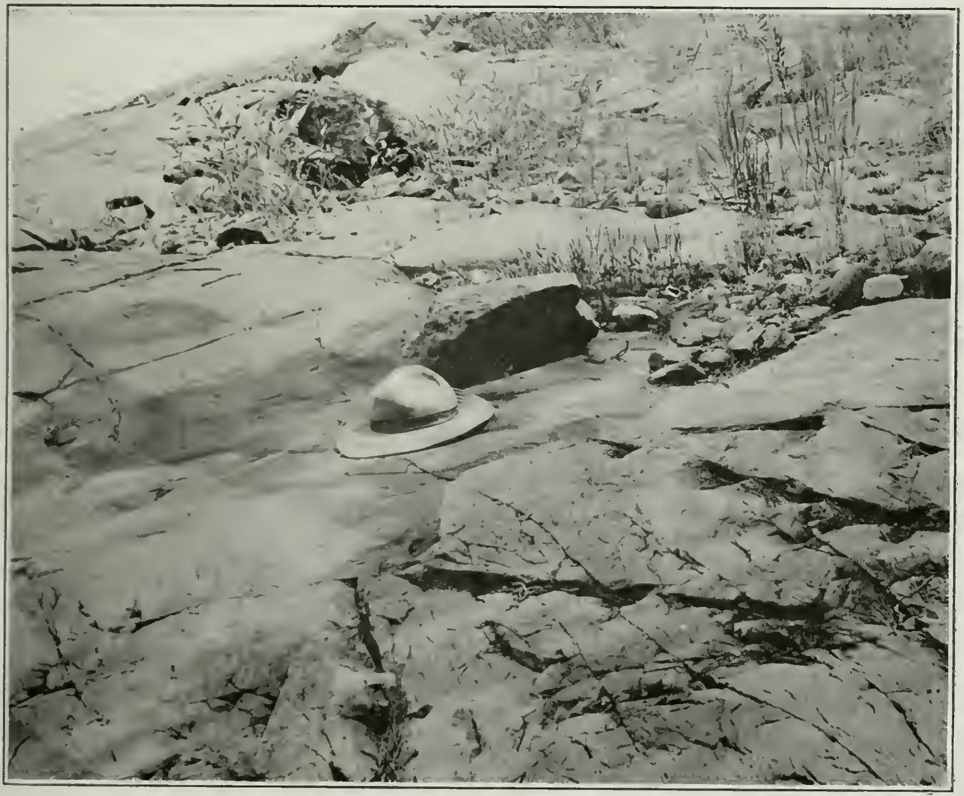


Fig. 1.—Granite grading to quartz porphyry, south side Lobstick bay.

In tracing the formations, the maps published by the Geological Survey of Canada, as the result of the labors of Dr. A. C. Lawson and Mr. Wm. McInnes, proved to be of invaluable assistance, and are used as the basis of the maps published in this report, with the exception of the region near the Manitoba border, in which case the Ontario Surveys Branch map was used. Additional information concerning the geography and geology of the Grande Presquile has been contributed by Dr. A. P. Coleman from unpublished notes, which have in large measure been confirmed independently by the writer.

In discussing the plan of work for the summer it was suggested by Dr. W. G. Miller, Provincial Geologist, that the source of the gold values might lie in the large granite areas, which are presumably of post-Keewatin age. That there might be some connection between the granite and the deposition of gold would at first sight seem to be probable, inasmuch as the more important mines on Lake of the Woods are at or near the contact of the granite and the Keewatin rock. That the granite is not the only rock connected with the deposition of gold in this region is shown by a study of the mines near Gold Rock and Dryden, where the rock adjoining the gold-bearing veins is usually, if not always, a sericite schist, which has probably resulted from the alteration of a quartz porphyry or an andesite porphyry, and it is almost certain that there is a definite relation between the later granites and these porphyries, as gradations have been found from one rock to the other, so that it may be assumed, although not without question, that these rocks are the gold-bearing rocks of the region. There may be, however, porphyries of two ages.

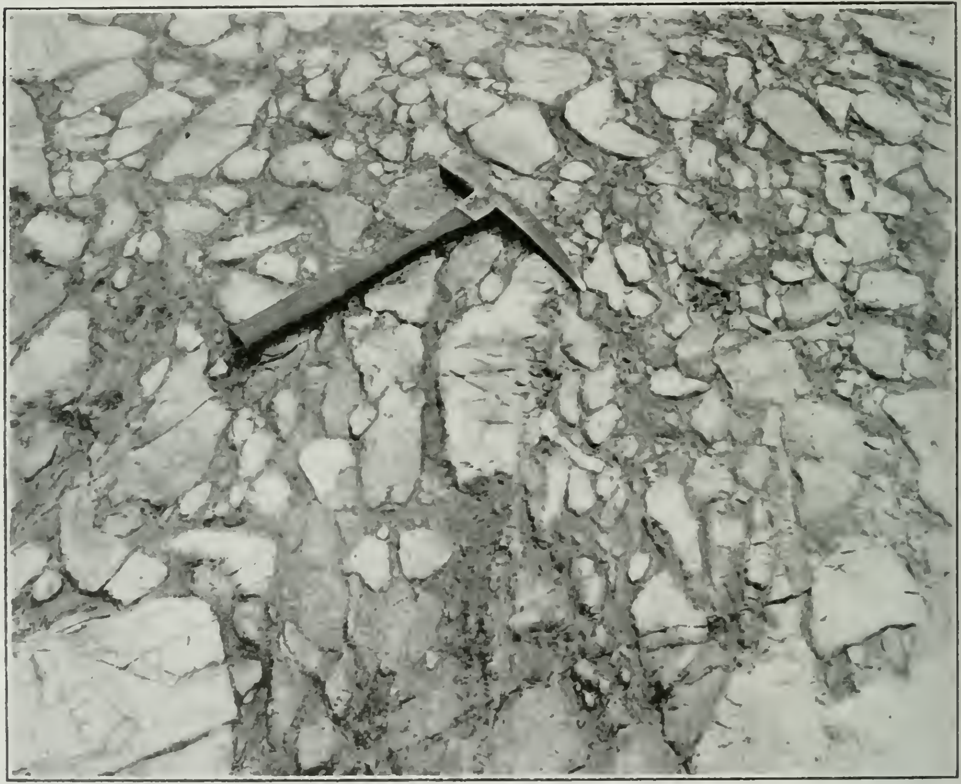


Fig. 3.—Agglomerate near pumping station, Kenora.

The gradation from the quartz-porphyries and andesite to the later granites is well shown on the south side of Lobstick bay, where in the area shown in the illustration (see Fig. 1) the two were found to be continuous, though other rock is present as an inclusion. This suggests the probability that the quartz porphyries or andesite porphyries of the region are contemporaneous with the so-called later granites, and are to be grouped with them. In suggesting this correlation, the similarity in mineral composition is a strong factor, as these later granites as well as the quartz porphyries are almost invariably characterized by a predominance of plagioclase feldspar, while the undoubted Laurentian granites of the region show a greater proportion of orthoclase. The description given later of the rocks at the Combined mine and the Bully Boy mine is characteristic of most of the porphyries, though in some cases quartz is also present in the form of phenocrysts.

On account of their highly altered condition, it was found difficult to work out the origin of many of the basic and acidic schistose rocks; but where this could be done the hornblende and chlorite schists appeared to be altered diabase or gabbro, and the hydromica or sericite schists altered quartz-porphyry or andesite.

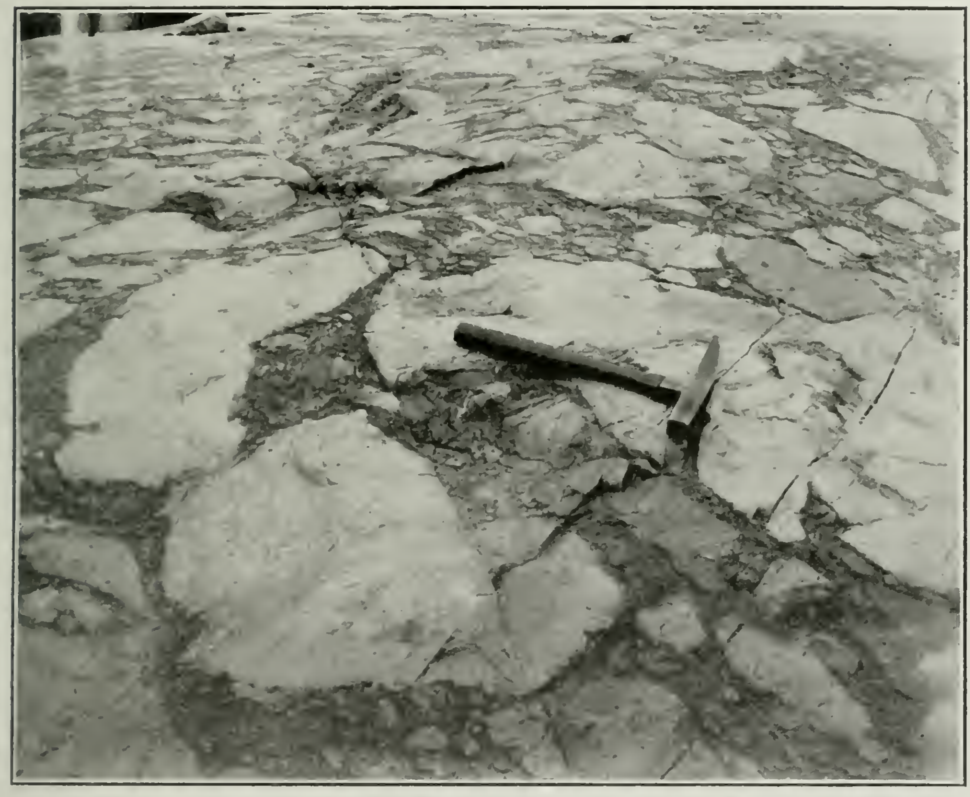


Fig. 1.—Agglomerate near pumping station, Kenora.

Geology

The region covered by the work of the writer in the past two seasons has attracted the attention of geologists for nearly a century, but the final mapping of the Lake of the Woods and Rainy lake regions was done by Dr. A. C. Lawson about twenty-five years ago, while the Manitou and Dryden areas were mapped by Mr. Wm. McInnes at a later date.

In the Lake of the Woods maps Dr. Lawson recognized the following formations:

LAURENTIAN.

KEEWATIN.

- Hydromica schists, etc.
- Clay slate, etc.
- Agglomerates.
- Hornblende schists and altered traps, etc.

LATER GRANITES.

LATER DIABASE.

In the Rainy lake sheet the Keewatin is further subdivided into

- Altered traps, etc.
- Conglomerates.
- Altered quartz porphyries, etc.
- Fragmental rocks, graywackés, volcanic tuffs, agglomerates.
- Soft glossy gray schists and slates.
- Gabbro.
- Serpentine.

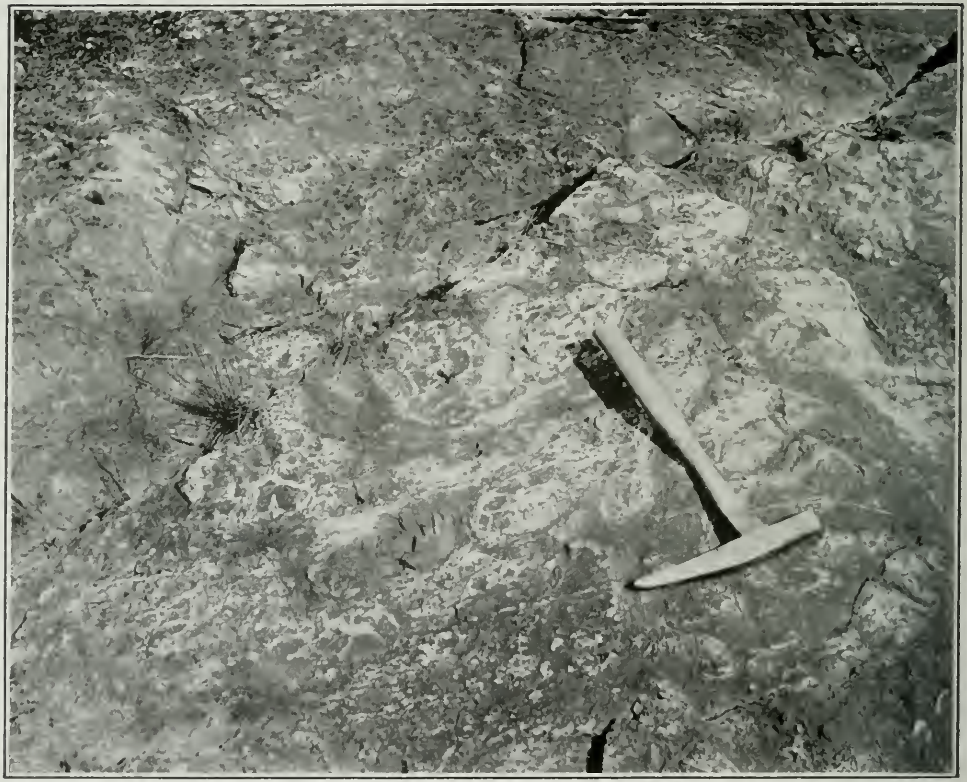


Fig. 5.—Trap (?) showing pillow structure, Gold Rock.

The other formations are the same as in the Lake of the Woods sheet, except that a new formation, the Couchiching, has been added.

In the Manitou sheet Mr. McInnes adopts practically the same subdivisions as are given in the Rainy lake sheet, but the conglomerates are omitted, inasmuch as none have been found in this area, and a series of rocks that are similar to the Couchiching are classed as highly altered Keewatin rocks, principally mica schists and fine gneisses.

The Couchiching of Lawson and highly altered Keewatin rocks of McInnes are formations which are the subject of much dispute.

Hornblende Schists and Altered Traps

The series is probably the most abundant of the Keewatin rocks. They are in general dark colored, and frequently have a well defined cleavage, and in composition range from diabase to diorite.

Agglomerates, Quartz-porphyry, Andesite-porphyry, Sericite-Schist

The work of the summer was devoted more particularly to these formations, and the conclusion was reached that they should be grouped together. The derivation of sericite schist from quartz-porphyry has been well shown by Dr. Lawson in his report on the Rainy lake region.[1] This alteration is clearly seen in the rocks on the east side of Oliver island in Lake of the Woods, where a nearly unaltered quartz-porphyry grades into sericite schist, with bands of carbonate, probably dolomite or ankerite.

The agglomerates may be in many cases acidic tuffs and breccias, but, as a matter of fact, it is often difficult to decide whether they are conglomerates or tuffs, or simply crushed rocks commonly called "autoclastic" rocks.

Typical agglomerates occur on the southeast point of Andrew bay. The rock seems to be a volcanic breccia in which volcanic bombs have been imbedded in a molten magma. It is, however, suggested by Dr. Miller that portions of the original magma may have cooled more rapidly than others and that by movements of the mass they became broken up and were then partially resorbed into the still fluid magma.

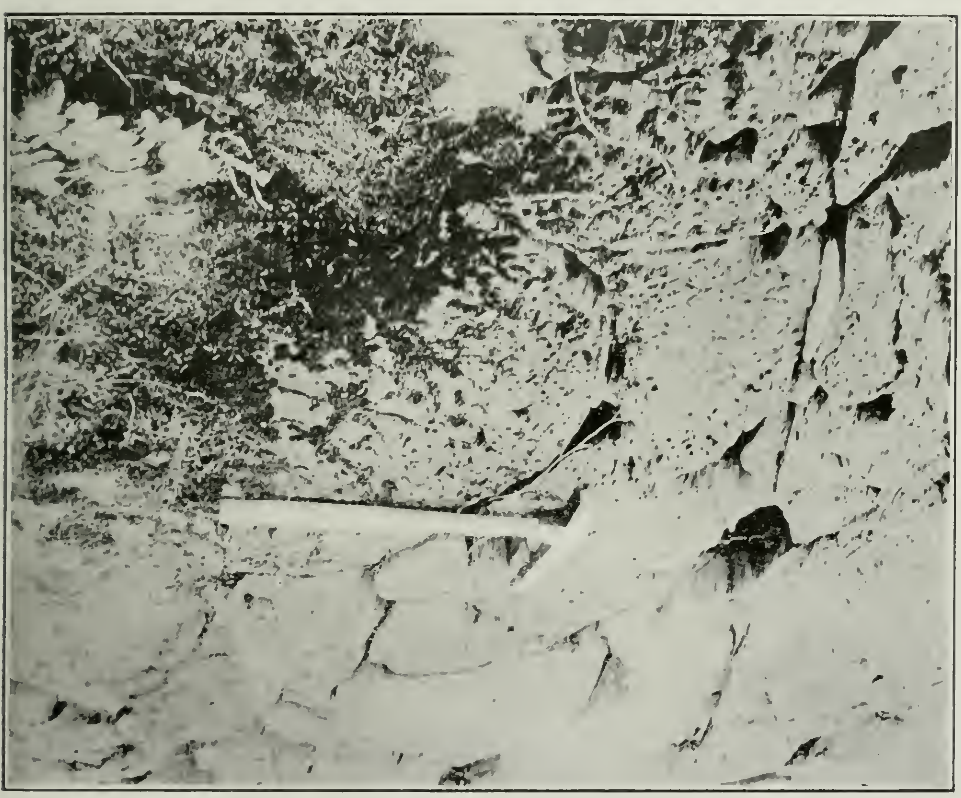


Fig. 6.—Pillow structure, Eagle lake.

This rock was slightly weathered, and when broken it showed very distinctly that it was made up of spherulitic nodules of a stony material in a ground-mass in which crystals exhibiting a conchoidal fracture could be seen. Several nodules of pyrite were also present in the hand specimen.

Under the microscope the section shows fragments of a rock made up of a very fine ground-mass which may be largely quartz, but from its appearance would seem to be more feldspathic; the crystalline particles are, however, too minute to give a satisfactory interference figure, but it would seem as though this material is much the same in composition as the rock in which it is embedded. The enclosing rock is a porphyry in which a schistose structure is imperfectly developed. The phenocrysts are principally plagioclase feldspar showing zonal extinction, though in some individuals the characteristic polysynthetic twinning is apparent. So far as could be seen, no quartz phenocrysts are present. In addition to the feldspar are a few phenocrysts of green hornblende, most of which exhibit twinning parallel to the orthopinacoid and in some cases this twinning is polysynthetic. Much of the feldspar has undergone decomposition, being converted into kaolin or sassurite. Scattered through the matrix are individual crystals of pyrite with occasionally large lenticular masses of the same material. No satisfactory evidence of the presence of muscovite is apparent in the section, but along certain planes it is to be seen in the hand specimen.

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[1] Geo. Sur Can 1887, 85-90F.

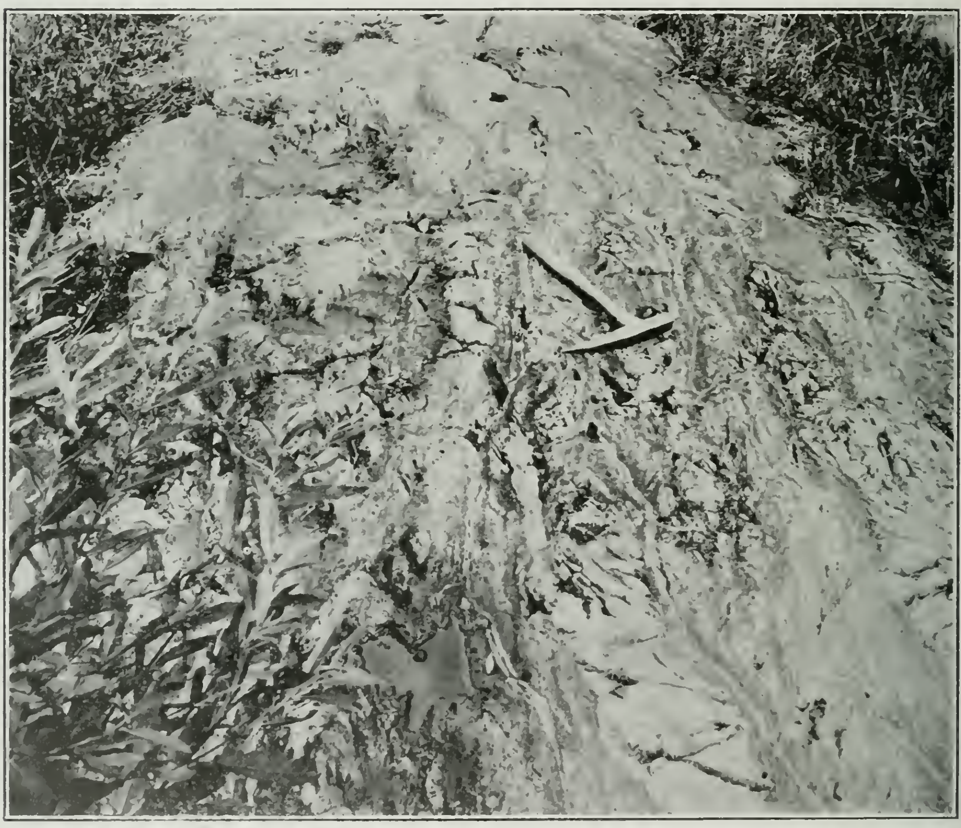

Fig. 7. Pillow structure, Little Master gold mine, Gold Rock.

The phase of the agglomerates exhibiting lenticular masses which are characterized as concretionary traps (often called ellipsoidal or pillow lavas) seems to have been formed by the cooling of volcanic flows in water, but in certain instances the two types are found in direct contact and even intermingled as shown near Gold Rock (see Fig. 5). The pillow structure itself is better shown on the shore of Eagle lake (see Fig. 6), and at this place typical agglomerate is near by, though not shown in the picture. A less altered type of rock showing the pillow structure is to be seen at the office of the Little Master mine near Gold Rock (see Fig. 7).

In general, it may be said that the conglomeratic type is more characteristic of the acid and intermediate volcanics, while the pillow structure is more characteristic of the basic rocks in this region, but this is by no means true in every case.

This series of rocks is of particular interest, as it has been shown that a similar series is intimately associated with several of the gold regions of the United States, notably the Comstock lode in Nevada,[2] and the gold belt of the Southern Appalachian mountains,[3] while a slightly more basic rock (phonalite) is characteristic of the Cripple Creek, Colorado, and Black Hills, South Dakota, regions.

In several places in the Lake of the Woods region and in the Detola mine at Gold Rock, graphitic schist is found intimately associated with the lighter coloured sericitic schists and slightly altered igneous rock. This is ordinarily looked upon as a proof of vegetable or animal life, and probably in most cases graphite must be referred to this origin.

A number of occurrences of graphite are known for which it is difficult to assign an organic origin, and for such cases it has been suggested by A. N. Winchell[4] that the reduction of carbon dioxide and carbon monoxide furnishes a probable explanation of the deposits. Although it is probably safer to assign an organic origin for these graphitic bands until further evidence is found for inorganic origin, it is by no means easy to harmonize the organic origin with the intimate association with igneous rock, as is particularly the case at the Detola mine. Is it not possible that these bands of graphite are associated with the formation of veins of ferruginous carbonate in the igneous rock, which by extreme metamorphism have given rise to some of the iron formation ?

Iron Formation

The iron-bearing rocks near Dryden and the pyrrhotite-bearing rocks near Ingolf may well be considered in connection with the discussions of the andesite-sericite schist series, for although the identity of conditions governing their formation cannot be absolutely shown, there are many points of similarity, and it is difficult to state positively that they do not have the same or similar origin.

As the contact between the highly altered rocks at Dryden and Eagle river and the Keewatin traps and andesites is buried, it was thought that it might be possible to determine the border of the iron formation by means of the dip needle, so that several lines were followed and the dip needle read every twenty-five steps. Except where iron ore was found the readings ranged from 24° to 35° on the highly altered rock as well as on the other Keewatin rock, so that there is ground for supposing that the content of iron does not vary to any marked degree, thus allowing the supposition that the rocks are the same. In the Gold Rock region two places are known where there is marked magnetite disturbance in the Keewatin rocks as mentioned in the last report.

In discussing the Dryden iron range, Dr. Coleman says:—[5]

> "While the customary rocks accompanying and underlying the iron range at Michipicoton are quartz-porphyry schists, in the western region they are replaced in may cases by gray mica schist or fine-grained gneiss, Lawson's Couchiching, sometimes enclosing the iron range, sometimes interbedded with it as east of Dryden, but sometimes separated from it by green schists.
>
> "It might be supposed that these Couchiching rocks are the equivalents of the quartz-porphyry schists, and more completely rearranged acid eruptives; but there are reasons for thinking otherwise. Dr. Lawson held them to be metamorphosed clastic sediments, sands and clayey sands, and there is much to be said for this view. His account of these schists places them beneath the Keewatin which he showed to be largely of eruptive origin, as a series of ordinary sediments of great thickness, covering a large area in the Rainy lake region. It is perhaps doubtful whether they are so sharply separated from the Keewatin as he supposed, since there are transitions between them on some of the islands in Rainy lake and elsewhere; and since he distinguished them from the Keewatin, very similar if not identical schists have been found in many other parts of the western Huronian . . . . . Under the microscope the usual minerals

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[2] King, Clarence, Geological Exploration of the Fortieth Parallel, III, pp. 13, 25-33.

[3] Becher G. T., U. S. G. S., 16th Ann Rep., Pt. II, pp. 17, 18. Jones, S. P., Geol. Surv. of Ga., Bull. 19, pp. 53-57, 59-64. Nitze and Wilkins, H. C. Geol. Surv., Bull. 10, p. 126.

[4] Econ. Geol. Vol. VI, pp 218-230.

[5] Bur. Min., 11th Rep. (1901), p. 144.

observed are quartz and biotite, neither of which is absent form the 25 thin sections examined, and often feldspars and muscovite, but less often chlorite. Among accessory minerals, in addition to the garnets and staurolites mentioned above, there are tourmaline and sillimanite, though not very frequently.

"The quartz often has dusty margins and sometimes rounded forms as if clastic, and the feldspars occasionally show the same character; but no later growth of the grains by additions from without has been seen, a point of difference from the quartzites and arkoses of the typical Huronian region. The feldspars include both orthoclase and plagioclase, often strikingly fresh, perhaps because of regeneration, but sometimes very turbid. The biotite is usually brown and only seldom green, and a small amount of muscovite is frequently present; hornblende less often. As secondary minerals chlorite and epidote as well as limonite occur."

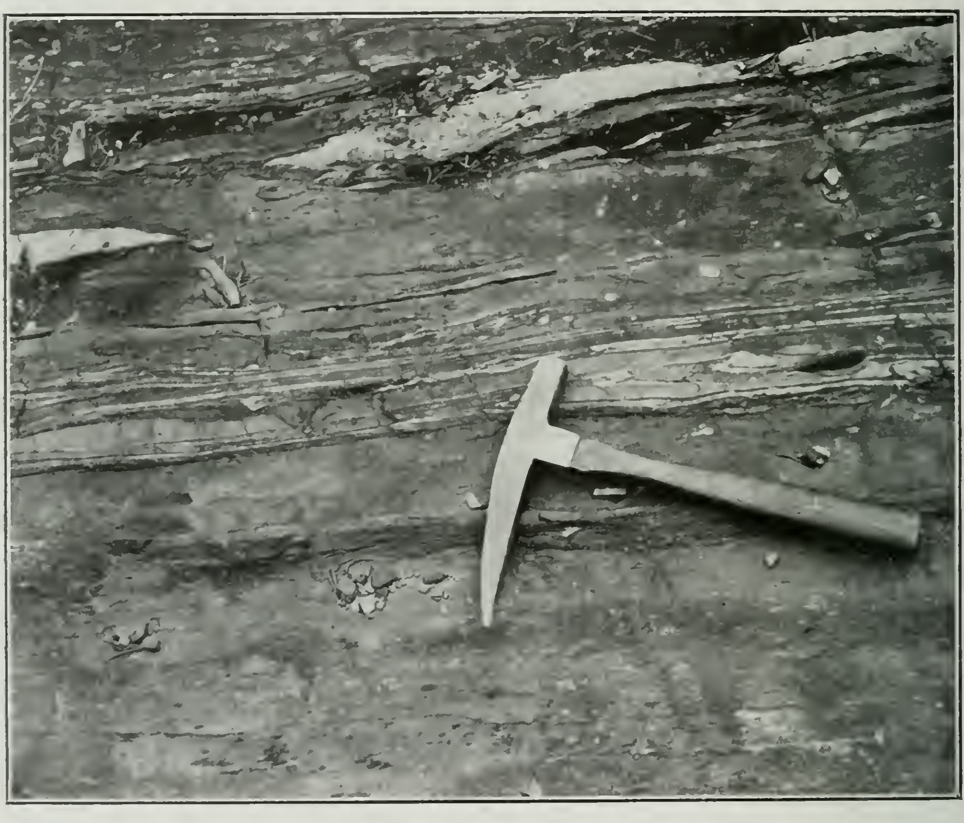

Fig. 8.—Iron formation, Dryden.

Dr. Coleman's conclusion is that the series is a completely recrystallized sediment. The writer's examination of these rocks agrees with Dr. Coleman's description, except that he has not recognized either sillimanite or staurolite in the samples examined.

In the case of the West Hawk lake series, however, there seems to be little doubt that a considerable portion of the rock is of an igneous origin, though there are strong arguments for considering much of the formation to be altered sediments. For field purposes the rocks here were considered as being of two kinds which were roughly classed as altered traps and altered felsites, the altered traps being dark hornblende and biotite schists while the altered felsites are lighter coloured micaceous schists containing both biotite and muscovite. These rocks are interbanded, and it is probable that some of the bands may be sediments, but the separation of the various bands requires detailed work involving more time than could be devoted to it, so that the limits only of the Keewatin area as exposed on the Manitoba boundary have been outlined.

A sample taken from the point on the east side of West Hawk lake, just south of the inlet from the east, is a schistose rock with considerable comparatively fresh plagioclase, muscovite and biotite in somewhat squeezed masses and crushed groundmass, and is aparently an altered igneous rock. Lenticular cavities have been filled with quartz and pyrrhotite, and considerable pyrrhotite is disseminated through the rock.

Another sample of a somewhat more schistose type was taken from the same point which contains more quartz, but also shows a good amount of feldspar, though the latter is more crushed than in the preceding specimen. The biotite in this specimen has been arranged in parallel position, and the rock approaches the Dryden type of rock more closely than the preceding, and is possibly a sediment.

In the opinion of the writer the Dryden iron formation and the Ingolf pyrrhotite formation are highly altered Keewatin rocks, though this has not yet been proven beyond the possibility of doubt, and it will be shown only by finding the gradation from one to the other. It is not necessary to assume in this case that all or even a considerable proportion of the formation is igneous, though there seem to be portions of the rock suggesting such an origin. If, however, these are to be looked upon as altered sediments, it seems necessary to explain why the unaltered or less altered sediments are not found in places at a distance from the great granite masses of the Laurentian and possibly other periods. So far as the investigations show, there is no sediment to which it could be referred, unless the agglomerate beds be looked upon as the source, but these are considered to be closely related to the second great igneous rock of the Keewatin. In many places the writer thought the gradation between the agglomerates and clay slates of Lake of the Woods was shown in the field, but the final proof has not been forthcoming on the study of sections. The results obtained with the dip needle seem to indicate that there is no great change in the percentage of iron in the iron-bearing formation and typical Keewatin rocks near Dryden, but even here the gradation from one type to the other has not been found in the sections. The large amount of quartz, garnet and sillimanite present in many of these rocks of the iron formation has been looked upon as proof that these must be altered sediments, but in the writer's opinion it is an open qquestion whether these are not the products which might be expected from the recrystallization of certain types of igneous rocks under different conditions of temperature and pressure, particularly if a part of the potash or soda in the feldspars had been removed by leaching of any sort between the period when the rock was first formed and the beginning of the metamorphism. In this latter case, however, the rock ceases to retain its true igneous character with the removal of the alkalies, and even though it is not transported it has the chemical character of a sedimentary rock. The field relations are such that no break has been shown between these rocks and the less metamorphosed Keewatin rocks, hence they are shown on the maps as highly altered Keewatin without attempting to correlate them to either of the two main divisions.

A sample of the rock taken a little less than half a mile south from the northern boundary of Zealand township on the line between lots 14 and 15 gave the following analysis:—

SiO_2	61.34
FeO Fe_2O_3	12.83
Al_2O_3	15.99
CaO	0.79
MgO	1.81
K_2O	2.56
Na_2O	2.03
H_2O	2.25

This rock will need further study before it can be definitely referred to either an igneous or a sedimentary origin, as it lies in the range covered by both.

Another sample taken about three-fourths of a mile south of the northern boundary of Zealand township between lots 8 and 9 shows the composition of an excessively basic diabase.

SiO_2	46.68
FeO	12.72
Fe_2O_3	
Al_2O_3	22.88
CaO	10.91
MgO	2.91
Na_2O	2.64
K_2O	0.34
H_2O	1.56

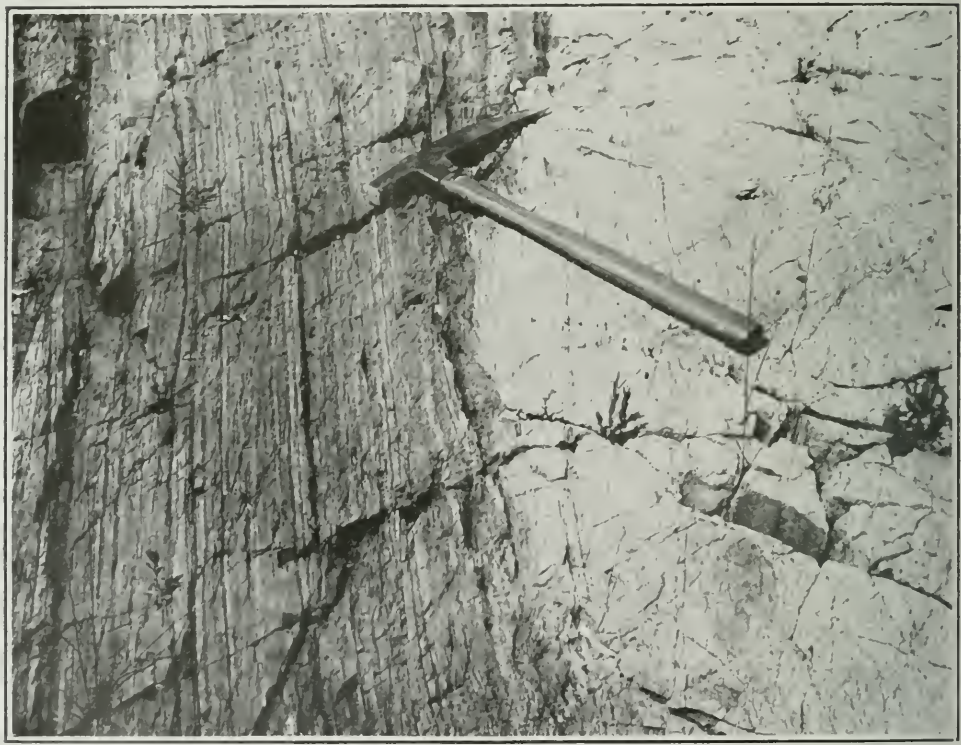

Fig. 9.—Contact, agglomerate (?) and clay slate, Queen island, Lake of the Woods.

Clay Slate

In discussing the clay slates of the Lake-of-the-Woods region, Dr. Lawson groups a series of mica-schists, micaceous slates, clay slates and quartzites together. As to the clay slates proper, it has been the misfortune of the writer that he has not been able to find a distinct slate in the areas which he has visited that are mapped as belonging to this series, but Dr. Lawson states,[6] "The clay-slates vary from hard-compact argillites to the readily cleaving blue black slate of commerce, the one passing into the other and merging into glossy micaceous schists." He also states on the same page that mica schists similar to one described, " merge directly with agglomerate schists in which the inclusions in the schist matrix vary but little from it in composition."

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[6] Geo. Sur. Can. 1885, 55 CC.

The observation of the writer in the field led him to the conclusion that most if not all of the series mapped as clay slate, etc., is only a highly metamorphosed phase of the agglomerates and sericite schist. As a rule these rocks are mottled and exhibit nodular projections like the agglomerates, though the nodules are usually of no great size. The great percentage of quartz present would suggest a sedimentary origin, but the presence of considerable amounts of fresh plagioclase would seem to indicate a relation to the agglomerates.

In certain cases apparent contacts between the clay slates and agglomerates may be seen (see Fig. 9), but usually there appears to be a merging of the one into the other as is shown at the bottom of the picture which represents the relations on the east end of Queen island in Lake of the Woods.

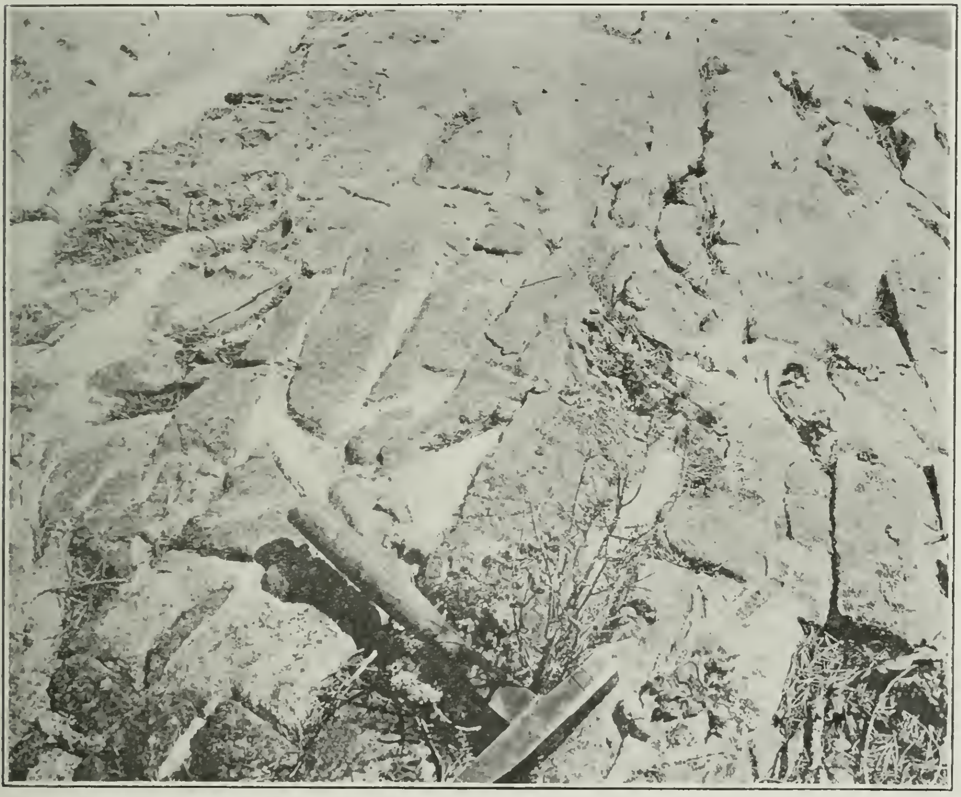
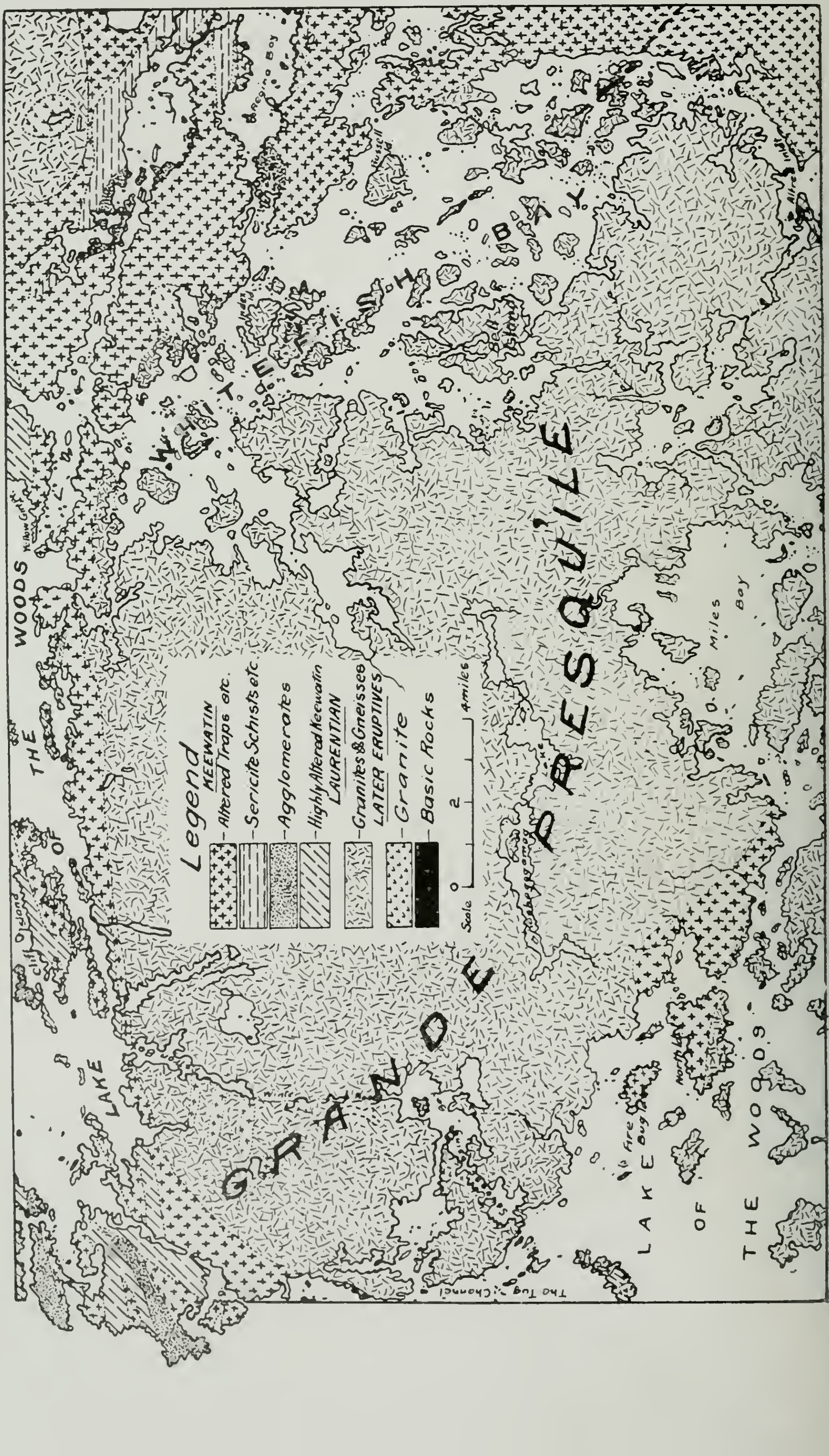


Fig. 10.—Breccia, Berry lake.

An analysis of the clay slate on Buckette island made by Mr. N. L. Turner, Provincial Assayer, shows conclusively that this rock has the composition of an altered quartz diorite, and thus approaches the so-called later granites of the region which uniformly are to be referred to this class. This analysis shows:—

SiO_2	69.20
FeO Fe_2O_3	3.10
Al_2O_3	17.50
CaO	1.68
MgO	0.12
Na_2O	5.84
K_2O	1.51


THE LAKE OF THE WOODS
WHITEFISH BAY
GRANDE PRESQU'ILE
LAKE OF THE WOODS
Miles Bay
Regina Bay
Yellow Girl Pt.
Fire Bug
The Tug Channel
Legend
KEEWATIN
Altered Traps etc.
Sericite Schists etc
Agglomerates
Highly Altered Keewatin
LAURENTIAN
Granites & Gneisses
LATER ERUPTIVES
Granite
Basic Rocks
Scale 0 2 4 miles

Breccias

Two types of breccias were recognized during the summer, the first being a diabase breccia enclosed in the Laurentian granite on the west side of Berry lake. In this case the diabase has been broken apparently in place by the granite, and has not been moved to any extent, as is evinced by the fragments of the same mass of rock remaining close together, showing even in the photograph (see Fig. 10) above the hammer handle that the fragmental material has suffered only slight displacement. This evidently is an early stage in the development of the lens-like inclusions found on the Grande Presquile. (See Fig. 14.)

The second type of breccia is connected with the movement of rock after solidification and represents brecciation due to vein formation. In this rock an almost agglomerate structure is developed similar to that at Kenora (see Fig. 2), but the brecciated material is all derived from the adjoining granite (see Fig. 11), which although shown on the map as Laurentian contains such a high percentage of plagioclase that it is possible it should be referred to the eruptive granites. This exposure is to be seen at the Grace mine on Eagle lake and represents some of the capping over the principal vein.

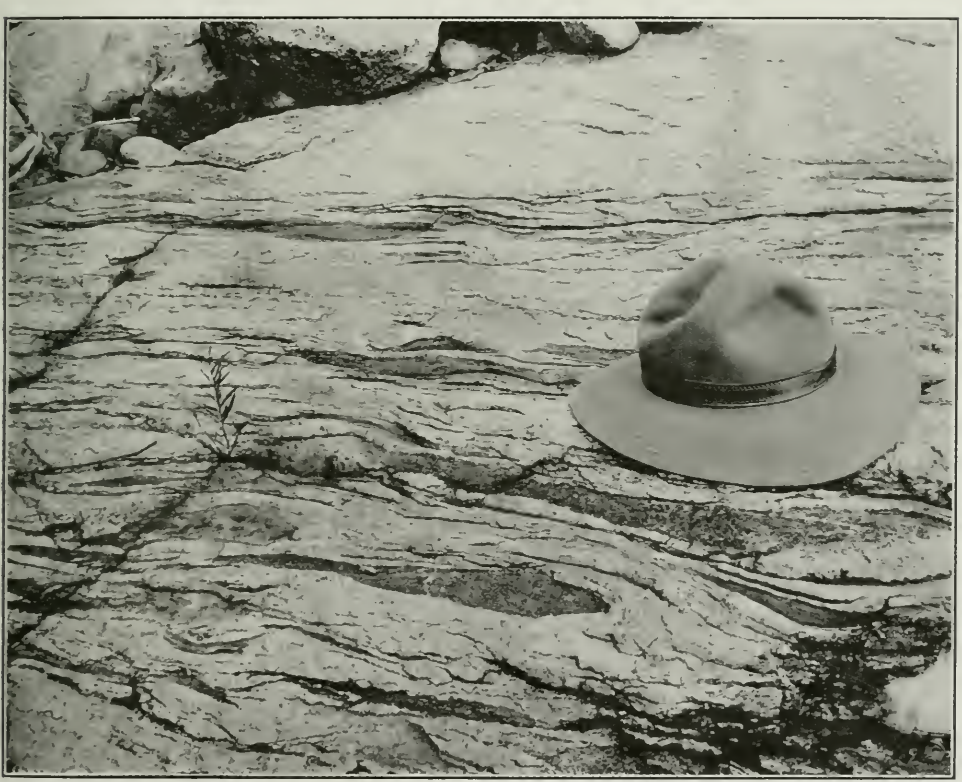


Fig. 11.—Keewatin inclusions in Laurentian, north side Miles bay.

The Grande Presquile

In studying Dr. Lawson's map of the Lake of the Woods region, it seemed that the Grande Presquile might throw considerable light upon the geological problems of this region. As is stated in this map, the interior of this peninsula is practically unexplored, but when we consider the general character of the region it would be natural to expect numerous lakes in an area of this size. At the suggestion of Dr. Coleman a visit was made to Kashagogamog or Arrow lake, a body of water eight or nine miles long. This lake has been visited and mapped by Dr. Coleman, though the map had not been published, and appears in the present report for the first time. The writer's sketch of this lake agrees essentially with Dr. Coleman's, though showing a greater extension to the west. The writer made two sections of the Grande Presquile, one slightly northwest from Sabascosing bay to an unmapped lake about a mile east of the south end of Astron bay. The inlet and outlet were not found, so that it is not known whether it is a tributary of Astron bay or of Maude lake, but the probability is that it is connected with Astron bay. In making the examination of this part practically all the rock was found to be Laurentian gneiss, but near the southwest point of the newly discovered lake, a small intrusion of diabase was found having a strike approximately north of 70 west. At the very south end of Astron bay, a small band of hornblende schist was found, but whether it may be looked upon as an intrusion could not be readily determined, though it had much the appearance of highly altered Keewatin inclusions in other Laurentian regions, though rather more altered than most of the Keewatin rock in this region.

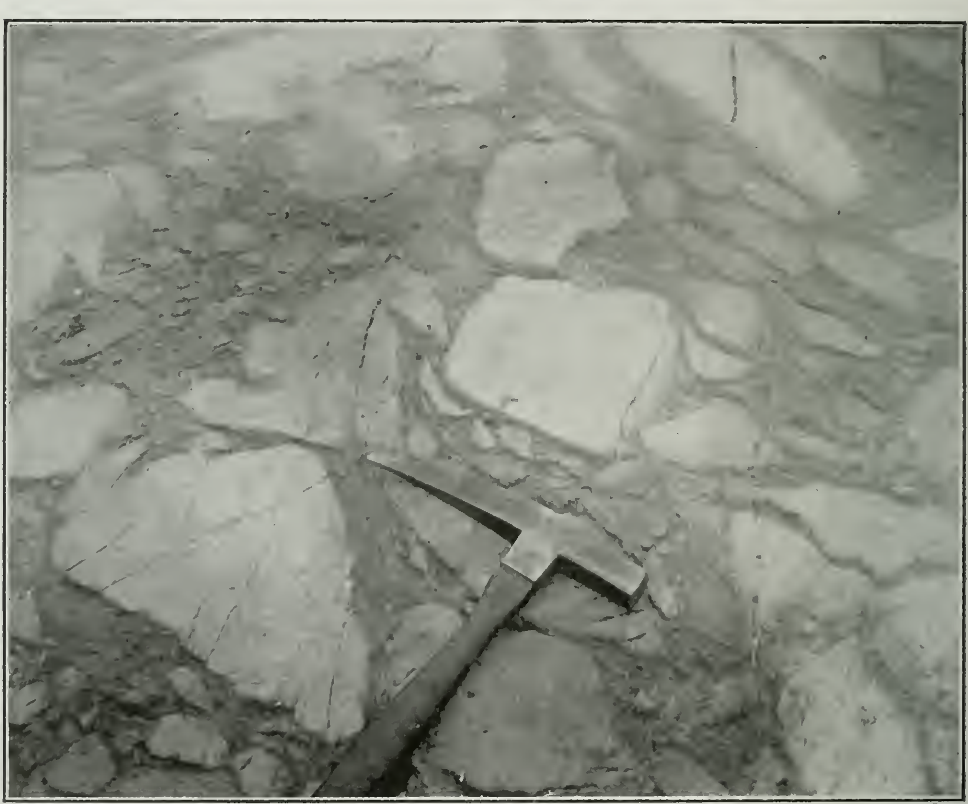


Fig. 2.—Agglomerate near pumping station, Kenora.

In following along the south shore in the Grande Presquile only minor changes in the mapping have been made, which increase the Keewatin area a little west of Starting point and on the island north of Fire-Bug island. Occasional inclusions of hornblende schists, which evidently are highly altered Keewatin traps, were found along the shore of Miles bay near the north end of which several good examples are to be seen (Figs. 14, 15, 16), showing angular inclusions in one case while in another case lenticular masses, which show the development of the structure by heat and pressure, are well shown.

At the north end of Miles bay is a winding stream which is navigable by a canoe for about four miles. This stream is the outlet of a chain of three lakes of which the most important one is Kashagogamog or Arrow lake. This body of water extends nearly east and west, and from information furnished by Mr. James Margach its western extremity is nearly north of Fish island, and it is about two miles north of the main body of Lake of the Woods at this point. This would place the western end about a mile farther west than the map shows it, but the map gives the essential features. With the exception of a small mass of Keewatin near the outlet of the lower lake of this series, all the rock surrounding these lakes is Laurentian gneiss. In going from Miles bay to Whitefish bay the rōute lies through Obabicon lake, which is only partly shown on former maps. The extension to the northeast in the present case is only approximate, but the portage from this lake to Boot bay is only about a mile long, and is probably the best portage aside from Turtle portage in going from Whitefish bay to the lower lake.

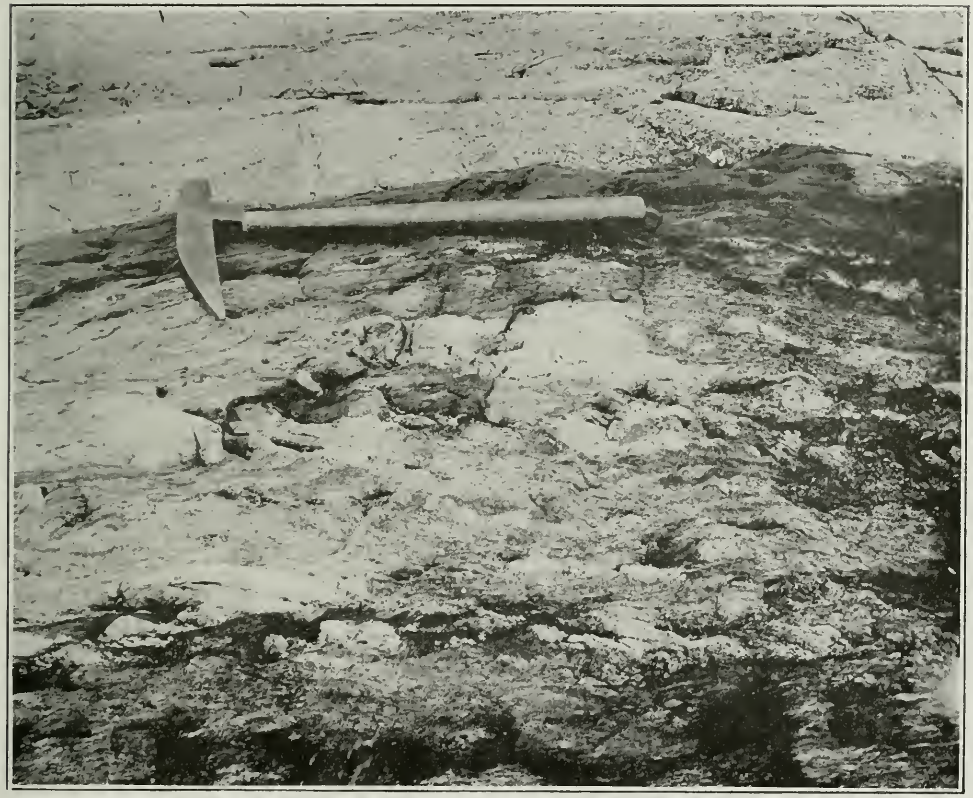


Fig. 11.—Brecciated granite, Grace mine, Eagle Lake.

The result of the geological examination of these three parts of the Grande Presquile is confirmatory of Dr. Lawson's statement that the rock is almost entirely granitoid gneiss. Several changes in geologic mapping have been made by Dr. Coleman, particularly in the north-western part of the peninsula and on the western shore of Obabicon lake, which in every case give an increased area to the Keewatin. The general conclusions reached by Dr. Lawson, however, have been confirmed, and this area may be looked upon as a huge batholith surrounded by Keewatin rocks. There is still considerable exploratory work possible on this peninsula, but from a mining point of view it would be unprofitable. There is, however, considerable land which might be cultivated with profit, though the first view would incline one to suppose that the country is too rocky for profitable cultivation.

Eagle Lake

The interest in gold mining on Eagle lake is in about the same condition as in the previous summer, except that some work was done on an island near the Grace mine, though the writer received this information after leaving this part of the lake, and consequently did not see the work. The greater part of the interest in mining in this region has been connected with a vein near the northern part of Net island, which has been looked upon as an iron deposit. During the previous winter this vein was tested by diamond drilling, stripping and the sinking of a small shaft. Diamond drilling was also done on North Twin island to intersect this same deposit. The vein as it is exposed on Net island varies from four to twelve feet in width, and on the surface is oxidized so as to present a mixture of limonite with small amounts of hematite and magnetite. Where excavation has been made the vein material is found to be largely made up of pyrite with small amounts of chalcopyrite. If this vein were better situated with respect to transportation facilities it should prove valuable as a source of pyrite, but as the deposit is of limited extent it would not pay to extend a railroad siding to it, and the only probable value would seem to lie in its possible gold contents.

Fig. 12.—Winter road, Grande Presquile, Lake of the Woods.

A number of claims have been staked out for iron in the neighbourhood of Detour Point where the highly altered Keewatin rocks of the Dryden iron belt apparently merge into the altered quartz prophyries and soft glossy gray schists which extend down to Lobstick bay on Lake of the Woods.

Dryden District

Mining conditions in the Dryden district show a slight improvement over 1910. At the League mine an experimental mill has been erected and one Nissen stamp has been installed so as to test the material from the shaft and other workings before erecting a large plant. The shaft has been sunk to a depth of 70 feet and the work is being continued. The secretary and manager expressed themselves as being highly pleased with the results obtained by the test mill.

The Good Luck claim, of which mention was made in the last report, has a shaft 25 feet deep with the vein persisting in about the same width as on the surface and continuing to show free gold.

Fig. 13.—Muskeg, Grand Presquile, Lake of the Woods.

To the west of Good Luck claim is a claim developed by Mr. Geo. Gordon, who during the summer sold it to the Dryden Mining Company of Cleveland, Ohio. The company are continuing the development which in August was represented by a shaft 17 feet in depth, and which in January, 1912, had reached a depth of 70 feet. This latter claim shows free gold and some of the specimens are exceptionally attractive.

In the Contact bay region several transfers have been made, most of the properties having been bought by the Dryden Mining Company. Considerable development has been done on many of the claims near the Good Luck and Gordon properties, and in several cases the indications are very promising, though the development is not so extensive as in the cases mentioned.

During the year the Redeemer mine was partially pumped out for an examination, but nothing further has been done. The writer can give no idea of the promise of this property, but was informed that the second level was not unwatered.

The mine and mill owned by Mr. White of Dryden was idle at the time of the writer's visit, but it was expected that work would soon be resumed.

Mines

In the Lake of the Woods region, work was carried on during the past year at the Mikado and Ophir, both of which present attractive features. It was expected that the Regina, Olympia, Cameron island and Scramble mines would be reopened in the near future, and it was reported that contracts for electric power had been let by the Scramble. Since leaving the district the writer has been informed by Capt. H. A. C. Machin, M.P.P., that the Olympia had resumed operations and has been producing gold. The Scramble is also reported to be continuing development work, having installed electrical machinery for hoisting. In most cases the mines visited were in charge of caretakers, which would indicate that the owners have expectations of reopening. In the case of those mines which were described in the last report no new description has been prepared, except as developments have been made in the meantime.

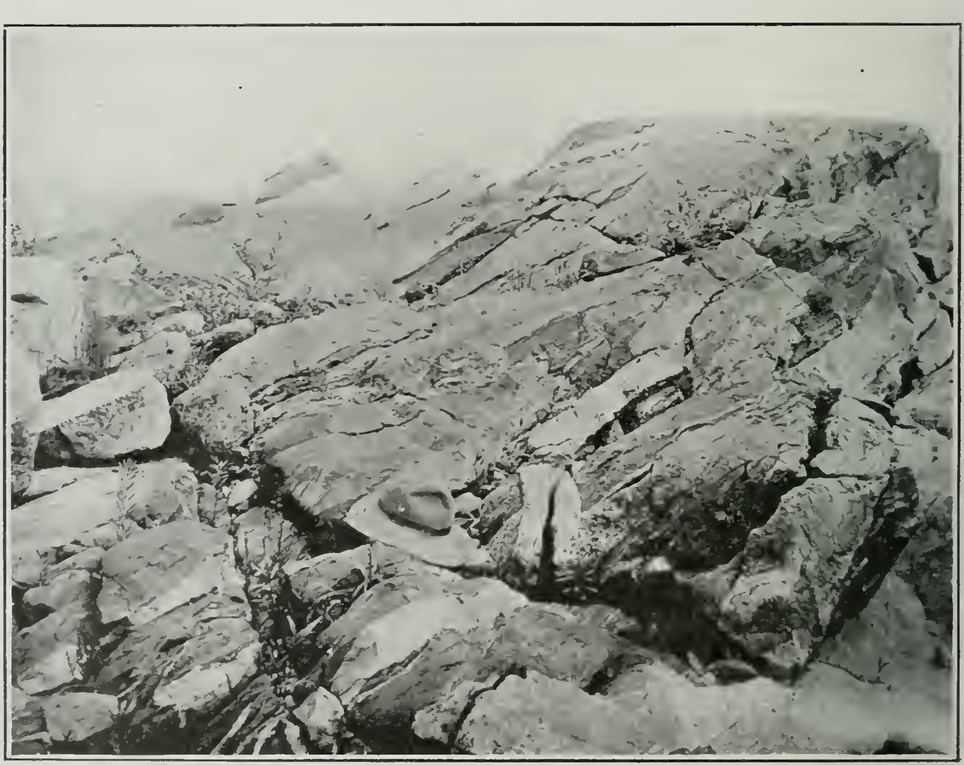


Fig. 15.—Granite intrusions in trap, north side Miles bay.

Bully Boy

The Bully Boy mine is situated about half a mile east of Camp bay, and the vein accompanies a porphyrite cutting altered trap. The shaft was filled with water, so that an examination of the underground workings was impossible. The surface equipment consists of a shaft house with two 45-h.p. boilers, one 8-drill compressor and a hoist with a 2½-foot drum. The mill equipment consists of one Blake crusher, four National ore pulverizers, three screens, two Strelow amalgamators, two Johnson vanners, one high pressure Corliss engine, one small hoist for the tramway from the shaft house to the mill.

The light coloured rock accompanying the vein shows on the freshly broken surface phenocrysts which have a conchoidal fracture and in the field would be taken for quartz; consequently it was assumed that the rock was quartz porphyry. On examining a thin section of this rock under the microscope, it was found that instead of being a quartz porphyry, the rock is a porphyrite having approximately the composition of andesite. The phenocrysts proved to be plagioclase, very similar in appearance to that found at the Combined mine, except that the zonal extinction was not so marked. Apparently the feldspar is albite or oligoclase. In the fine ground-mass are to be seen minute specks of biotite. The rest of the ground-mass consists of a fine grained aggregate of colourless minerals which are too minute for accurate determination, but are apparently feldspars. The cut (Fig. 20) shows the general characteristic of the rock, and the contact with a quartz vein. The minerals in this rock are unaltered, or if altered, only slightly. The rock is undoubtedly the same as the porphyry found at the Combined mine, and with that may be looked upon as the key to the series which include the quartz porphyries and sericite schists of Lawson and McInnes.

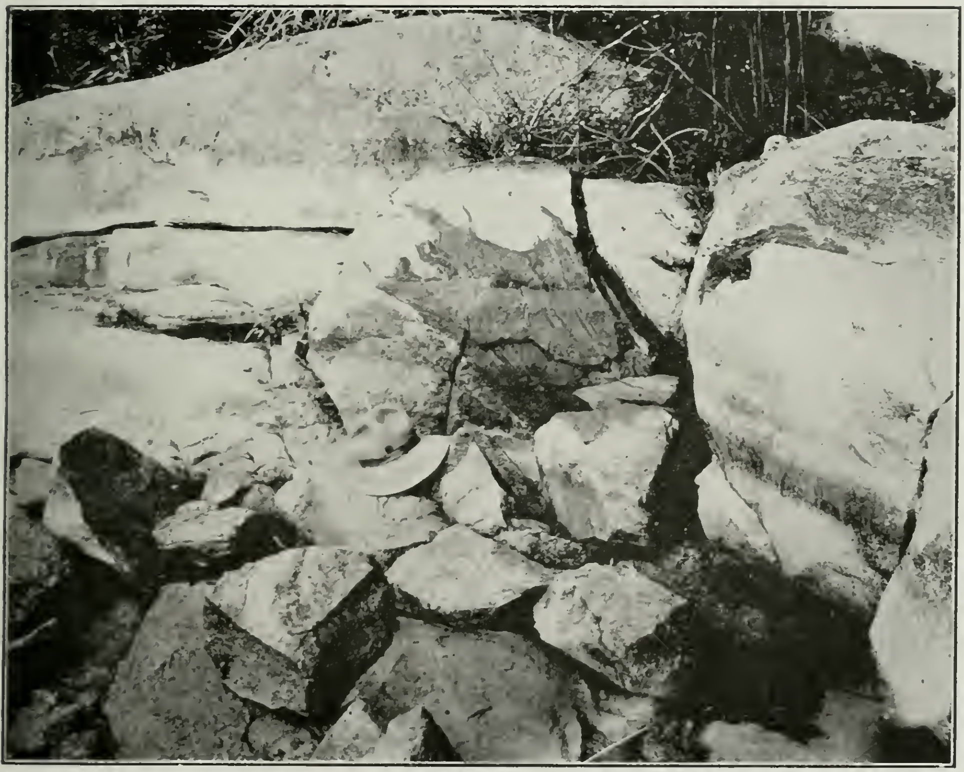
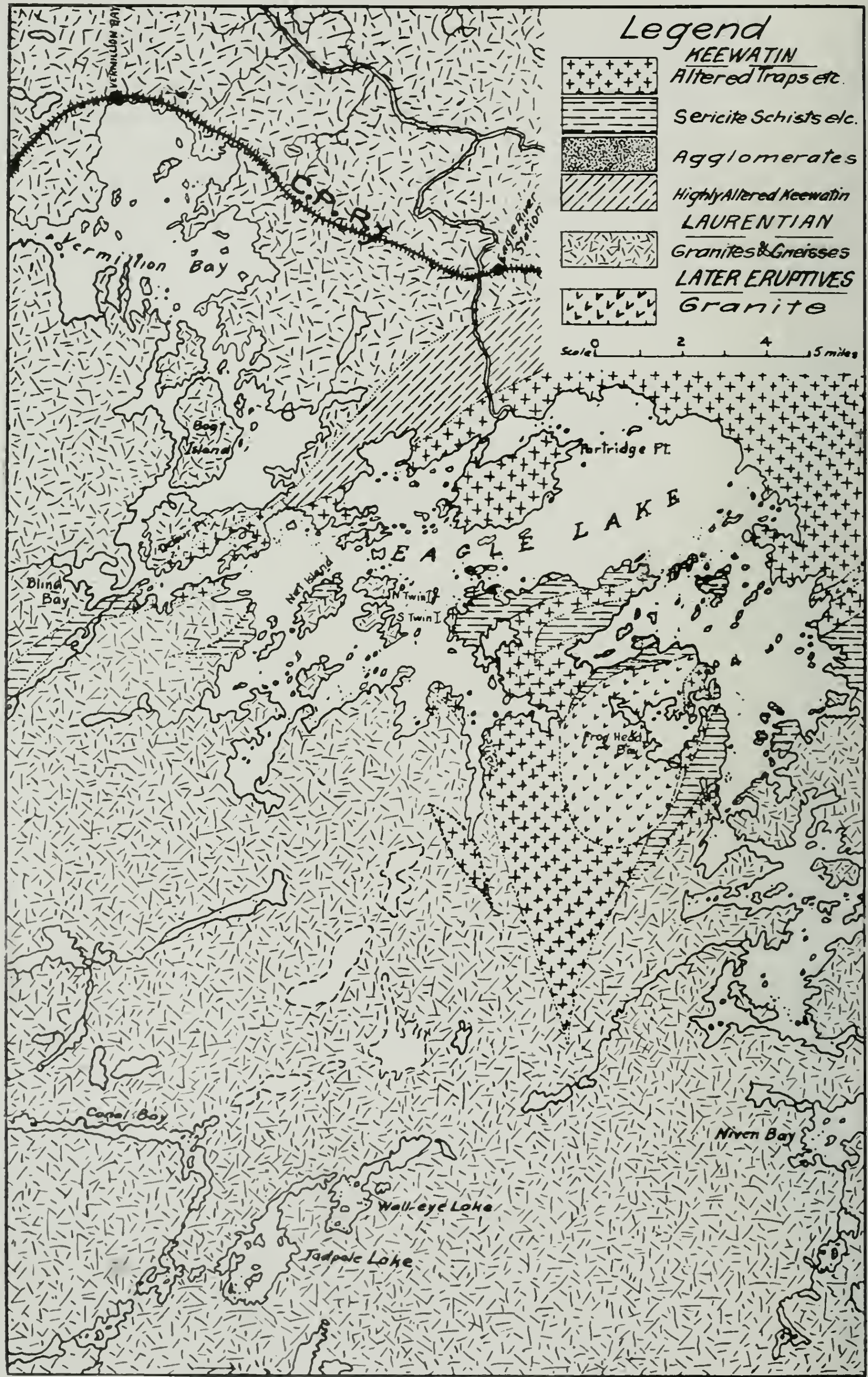
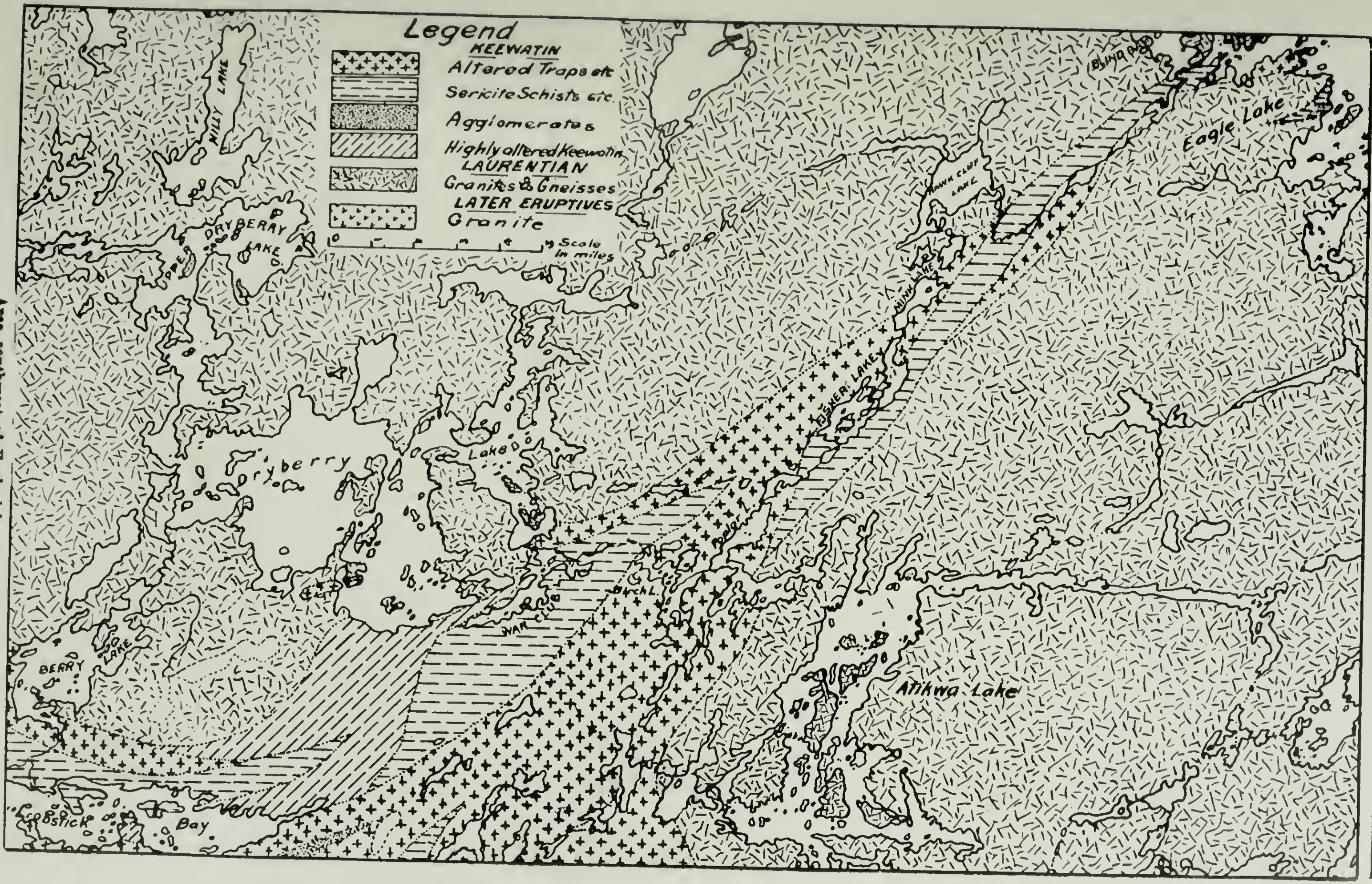


Fig. 16.—Keewatin rock included in Laurentian, north side Miles bay.



Eagle lake area.



Area southwest of Eagle lake.

Combined Mine

This mine has been described in detail in the thirteenth annual report of the Bureau of Mines, so that it will not be necessary to give the equipment. The vein is nearly horizontal, though its dip varies considerably. By some it has been looked upon as a blanket vein which lies between overlying trap, exhibiting a pillow structure, and a dark underlying felsite or finegrained quartz (?) porphyry. With the quartz, which in the principal vein varies from two to four feet in thickness, is a large body of rusty carbonate rock which seems to be derived from the alteration of a quartz (?) porphyry or felsite and shows considerable sericite. In places this rock becomes a calcareous sericitic schist.

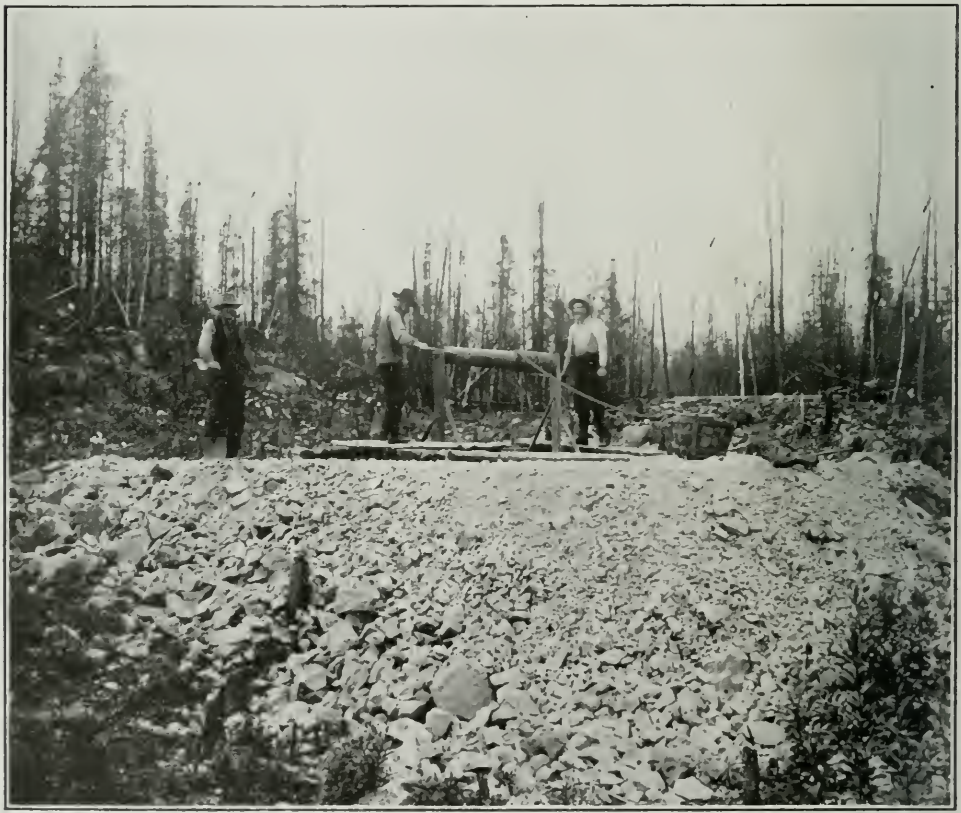


Fig. 19.—Gordon claims, Dryden.

The rock on the surface is all much altered, so that information as to the origin of the rock could not easily be obtained. It was found, however, that exploration had been done with the diamond drill, and an examination of the core which was lying near the shaft house showed the rock to be made up of a dark rock which may be looked upon as more or less altered trap, and a light rock which when broken showed several small crystals exhibiting a conchoidal fracture, and at first supposed to be quartz, hence for field purposes the rock was looked upon as a quartz porphyry. On examining a thin section of this latter rock, it was found to be a porphyry, whose phenocrysts instead of being quartz are plagioclase feldspar in distinct individual crystals and twin crystals which exhibit beautiful zonal extinction. From the extinction angle of this plagioclase, it appears to be from the albite end of the series and probably indicates that the first part to separate out was andesine or oligoclase, while the latter part is albite. The ground-mass is extremely fine grained and is made up principally of feldspar in which are a small number of inclusions of chlorite, and a few larger crystals of hornblende altering to chlorite. The texture of this rock is shown in the accompanying illustration (Fig. 21), and is undoubtedly that of an andesite.

Ophir

During the winter of 1910-11 the shaft of the Ophir was sunk from 80 to 130 feet, and a drift was started at about 40 feet in depth and a second one at 100 feet. As the manager, Mr. Richards, was unwilling to let anyone go down the mine without permission from the owners, and as it seemed that work under such conditions would be unsatisfactory, the underground workings were not examined. Gold was seen in the ore car at the mouth of the shaft which seemed to indicate that the glowing reports of the richness of this prospect by those who have visited the place in the past are not exaggerated. The condition of the surface development is represented by the accompanying illustration (see Fig. 23). During the summer the company owning the Ophir had an examination made by Mr. R. B. Nickerson, M.E., former manager of the Laurentian and Mikado mines, and as a result Mr. Nickerson was employed to push forward the development of the mine.

Fig. 20.—Bully Boy mine, Camp bay, Lake of the Woods.

The Mikado Mine

This mine has been described in greater or less detail in several of the reports of the Bureau of Mines, and was examined in 1910 to determine whether the vein was a fissure vein or not; but as the first four levels only were accessible at that time and during the winter it had been pumped out to the ninth level, it was deemed advisable to make a more detailed examination.

The rocks in the mine are of two general types, felsite and altered traps. In considering altered traps it may be mentioned that there is much variation from the typical dark green to black material, and in all probability some of the lighter portions of the rock should be classed as altered quartz porphyry or andesite, but as the amount of the light coloured rock is not so great and as it is of such a fine character that it could only be determined by chemical analysis, no attempt was made to distinguish it from the other Keewatin rocks. It is thought that the distinction between the felsite and the Keewatin rock serves every purpose that can be gained by an examination of this mine, though in other places andesitic rocks play an important role. As will be seen by reference to the accompanying sketches, which represent the foot and hanging walls respectively, the stoping has been done principally in the felsite and for a short distance in the adjoining traps. At the upraise on the seventh level values have been found as reported by the manager, Mr. Nickerson, and engineers who have sampled the mine, varying from twelve dollars to fifty dollars.

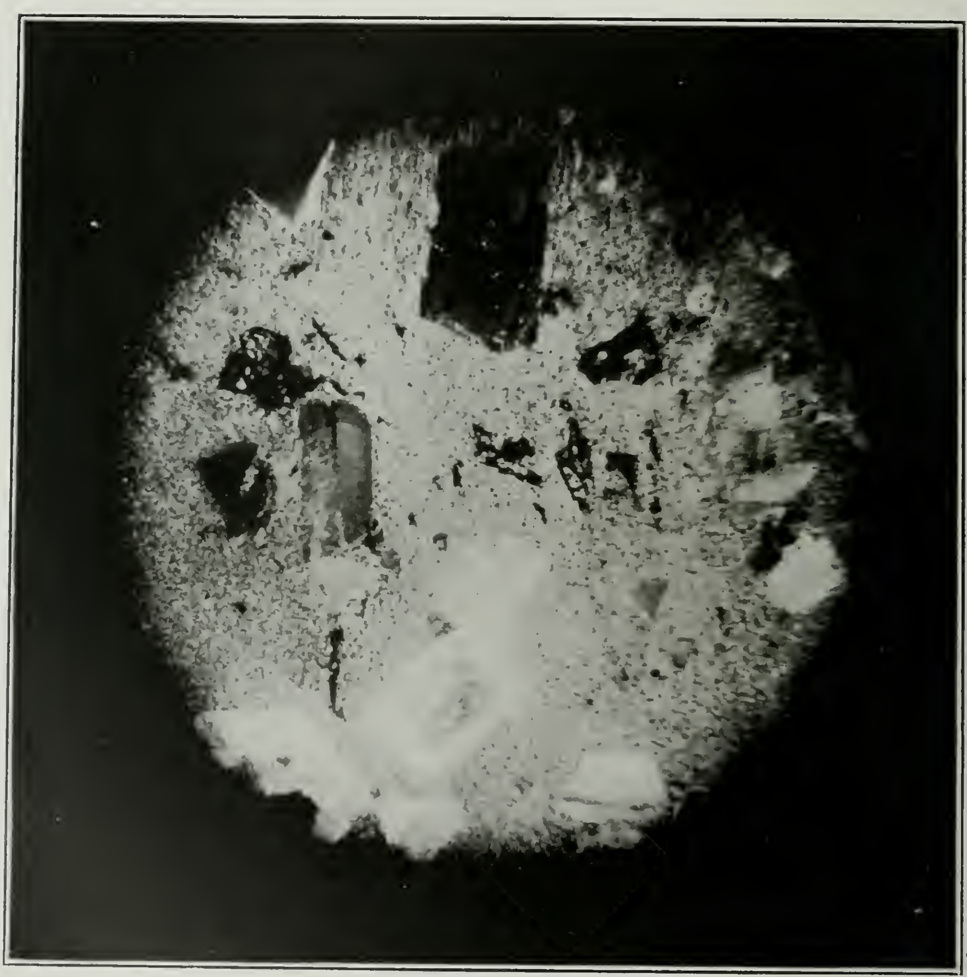


Fig. 21.—Microphotograph of andesite, Combined mine.

The sections shown indicate very clearly that the vein is a fissure vein, and that the rock has not been greatly thrown at this point. With the exception of the first mass of felsite north of the inclined shaft on the fourth level, the indications are that the felsite material is all in the nature of inclined dikes parallel with the granite to the north, and in the area explored it would seem that there are six definite dikes with minor outcrops that may be distinct or may be branches of the larger masses. From a study of the surface conditions, it would appear that there is strong probability of encountering granite within a very short distance of the north end of the fourth level, and when we consider that in the Sultana and Regina mines the values were principally near the contact of the granite and traps, it seems desirable that further explorations should be made at this point to prove the possibilities of the granite contact. So far as the development of the mine at present is concerned, the evidence from the geology and the workings indicates that the values have been found only in the vicinity of felsite. All or nearly all of these felsite sills appear on the surface, and if it be true that the felsite is the gold-bearing rock it will probably not pay to explore further toward the south on this vein, as it is thought that the last visible outcrop of this rock on the surface has already been cut in the workings. The rearrangement of the surface plant was described in 1910, and nothing further need be added to that description. The living accommodations have been much improved, and a force of about twenty men were employed up to June 1st, at which time the mine was temporarily shut down.

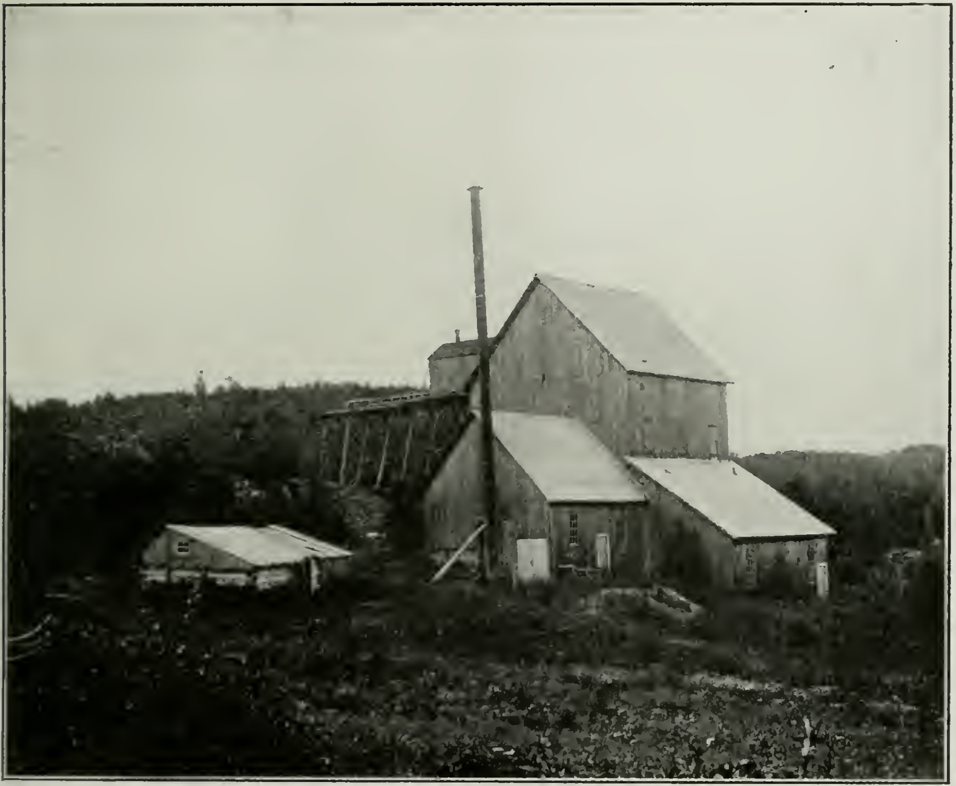


Fig. 22.—Mill of Combined mine, Camp bay, Lake of the Woods.

During the winter of 1910 and 1911 considerable drifting was done on the fourth and seventh levels, and the good values on the seventh level were discovered, which give promise of the profitable development of a second ore body in the mine.

Manitou District

In the Manitou district a moderate degree of activity has been shown in the past year. Development was carried on at the Detola and milling was in progress at the Laurentian, while during the summer the Independence changed hands and it was reported that the Big Master was to be reopened.

In regard to the geology of the Gold Rock region, the essential features were shown in the map prepared last year but it has been found that the altered traps are in many cases quite acidic and grade into diorites and andesites, and considerable masses show a decided agglomerate structure.

As to other parts of Maniatou lake, no attempt has been made by the writer to map the formations, but certain exposures of rock were visited to secure material for comparative purposes.

Fig. 23.—Ophir mine, Lake of the Woods.

The Detola Mine

Since my last visit to Gold Rock work was carried on at the Detola mine until the day preceding my arrival, at which time the mine was closed down temporarily. The principal work consisted in driving a cross-cut on the 235-foot level northwest and southeast. The total length of the cross-cut is 852 feet, of which 509 feet extends northwest from the shaft and the remainder in a southeasterly direction. It was thought that by sampling the walls of this cross-cut specimens might be secured which would show less alteration than the surface rock, and thus serve as a better guide to the geological mapping of the region than the more altered surface materials. Samples were taken every 20 feet. In the northwest cross-cut a vein was found 436 feet from the shaft, which seems to correspond with the vein exposed on the surface known as the

Jack-pine vein. As it is exposed in the drift, this vein is about a foot wide, which is about the same as the width of the surface exposure. The manager, Mr. Dryden Smith, informed me that this vein carries values of about $12 per ton.

During the year the mill building was completed and the milling machinery installed. A new boiler house and a tank house have been erected on the hill just above the mill. The equipment is in first class condition.

A small band of graphitic schist was found about 120 feet northwest of the shaft in the 235-foot level, which is similar to the graphitic schists in Ptarmigan bay of Lake of the Woods, and apparently the association is the same. The graphitic schists in the Lake of the Woods region are found in hydro-mica schists, while the material in the Detola mine occurs in an altered igneous rock, which was referred by Mr. McInnes to the same formation. From the fact that in certain mining regions the graphitic schist is looked upon as a favorable indication in the search for gold, it was thought that the values at this point might be greater than in the rest of the rock, but so far nothing has been found to indicate that greater values accompany the graphite. From the surface indications the writer was inclined to refer the rock at the Detola to the altered traps in the work of the preceding summer, and the samples taken underground seem to indicate that he was correct in the main, though in places the rock comes very close to the andesite series.

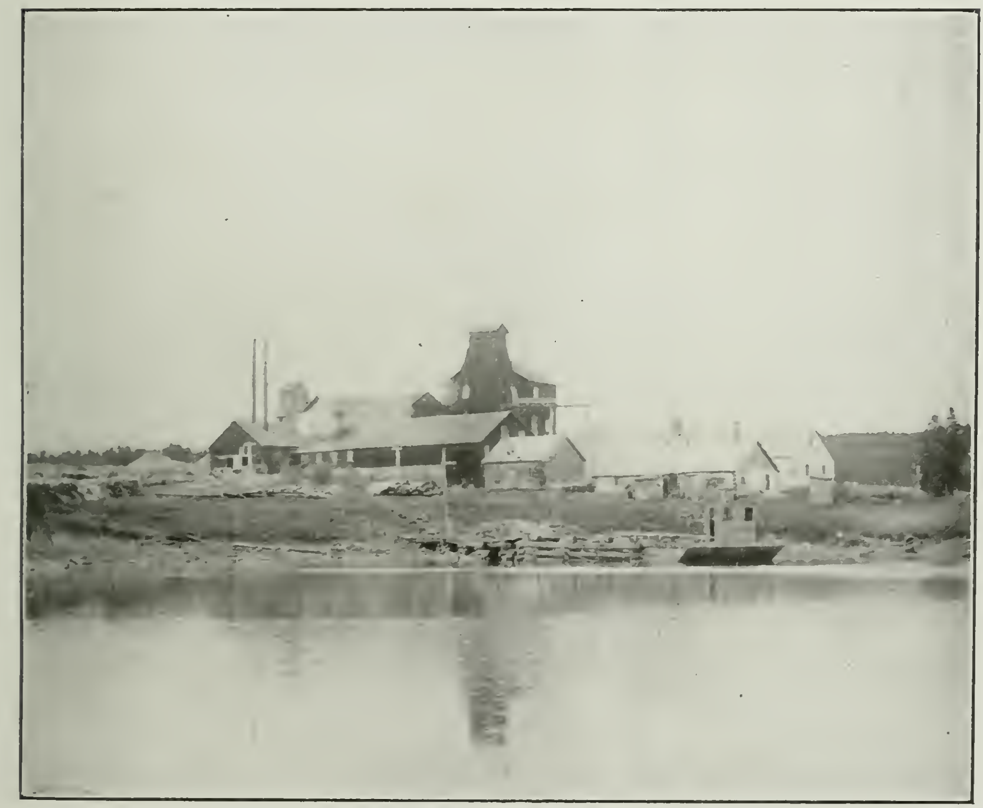
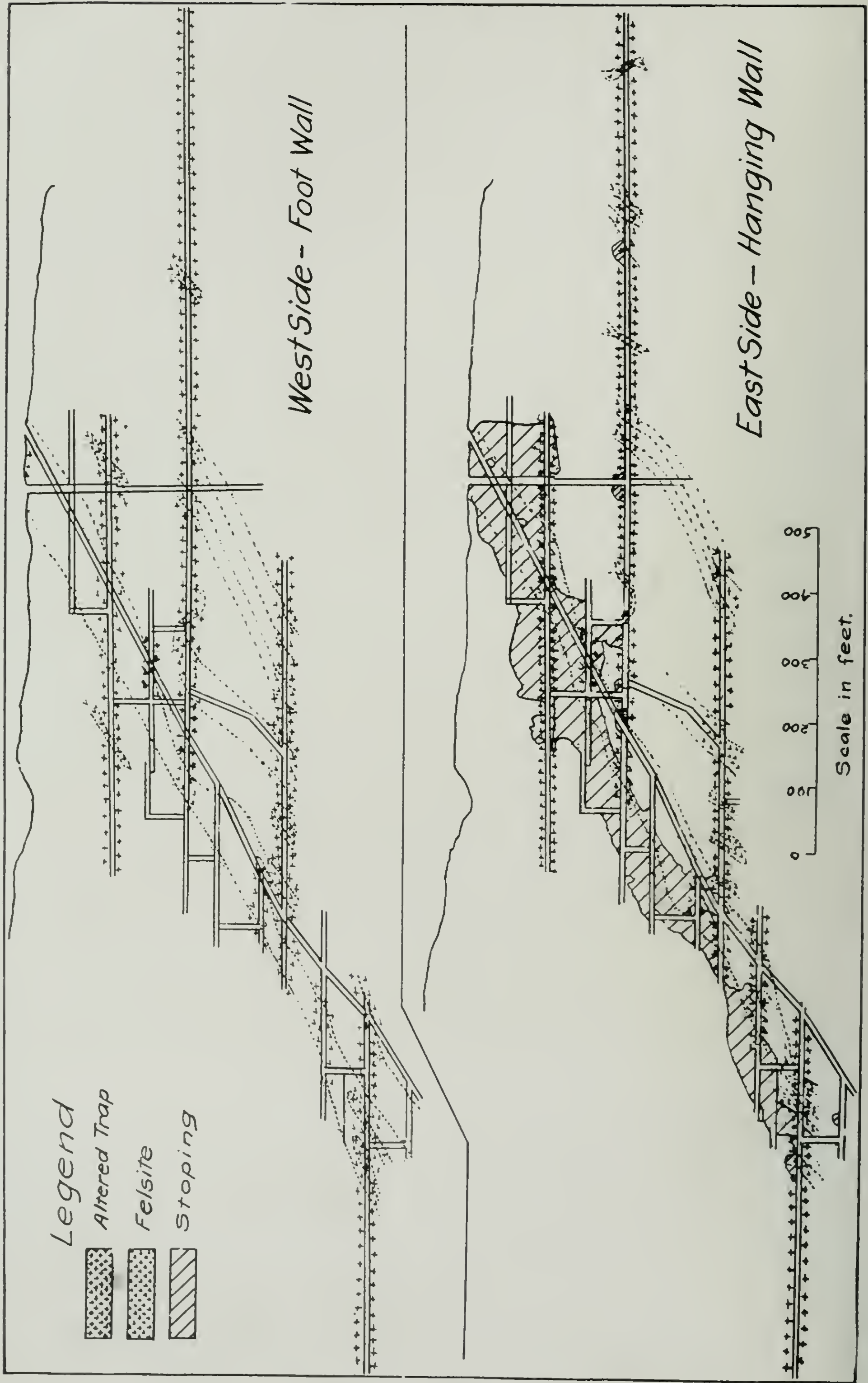


Fig. 24.—Mikado mine, Shoal lake.

The examination of the material secured on the 235-foot level shows conclusively that the rock here is not a quartz porphyry, though in some cases it is porphyritic. In no case has the writer found original quartz, and the feldspars are always plagio-



Workings of the Mikado mine.

clase. In most cases the plagioclase is labradorite, sometimes with ophitic texture, though occasionally occurring as phenocrysts or nodular aggregates in a fine groundmass. The rock appears to grade from an almost typical diabase to a rock having much the composition of anorthosite. In one instance the rock approaches andesite in composition, though it can hardly be correlated with the rock from the Combined mine on Lake of the Woods as can the rock to the west of Gold Rock, which bears a very close resemblance to the andesite of this mine. It may be noted in this connection that isolated specimens taken near the Big Master and Laurentian mines also approach andesite in composition, though for the most part the rocks are decidedly more basic, except adjoining the vein. It may also be stated that no close line of distinction can be drawn which will separate these rocks in mapping, and in interpreting the map of the Gold Rock region it is only possible to give a broad generalization, for if an observer comes upon this area, after working in a region of altered traps, the tendency is to group most of these as traps, while when coming from a region of altered andesites nearly all of them would be classed in the field as andesites.

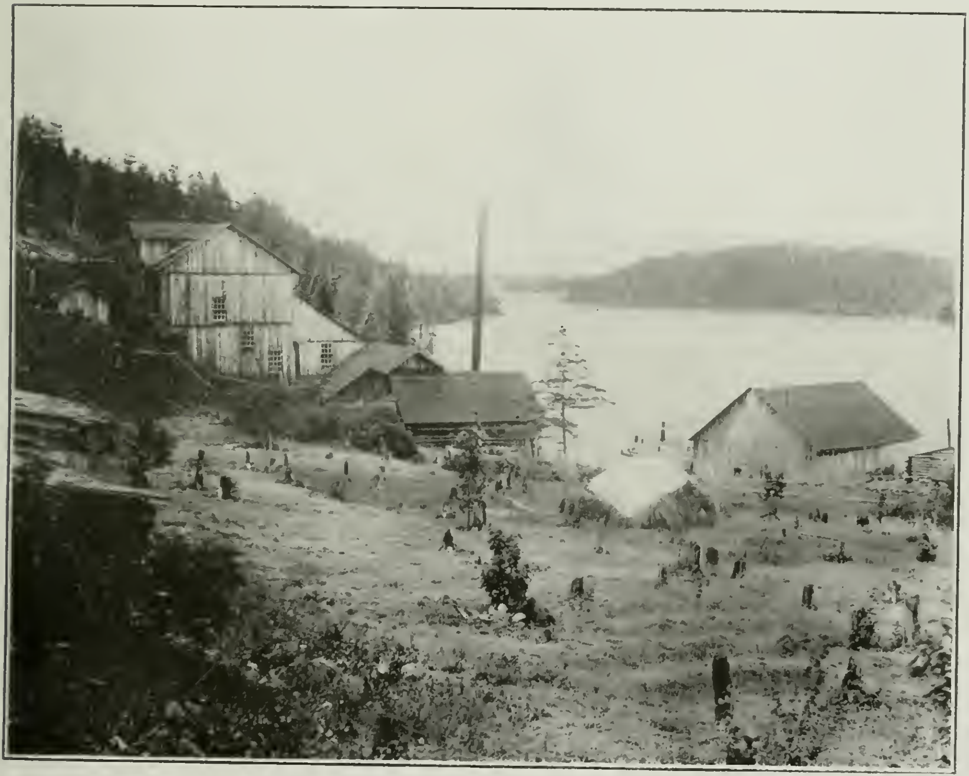


Fig. 17.—Grace mine, Eagle river.

The Laurentian Mine

Through the courtesy of Mr. Bakewell, the manager of the Laurentian mine, the cross-cuts and drifts were examined and samples of the rock taken at frequent intervals. Particular attention was paid to the cross-cuts, as these show the greatest variety in the rock.

In texture and composition the rocks shown in the cross-cut exhibit about the same range as at the Detola, though there is a greater amount of basic rock showing the ferro-magnesian silicates, chlorite and hornblende. The rock is in general quite free from quartz except at the veins.

At the time of the writer's visit work was in progress, and about a dozen men were employed in hoisting material that had been broken down in the stopes and putting it through the mill. The development of the mine is in practically the same condition as it was a year ago, but when the supply of ore in the stopes is exhausted it is expected that further development will be undertaken.

Big Master Mine

Since my visit to Gold Rock it has been reported that the Big Master mine has been pumped out, and that development work is being carried on. Inasmuch as this mine has been looked upon as one of the promising properties in the district, it is to be hoped that the new management may be successful in their venture.

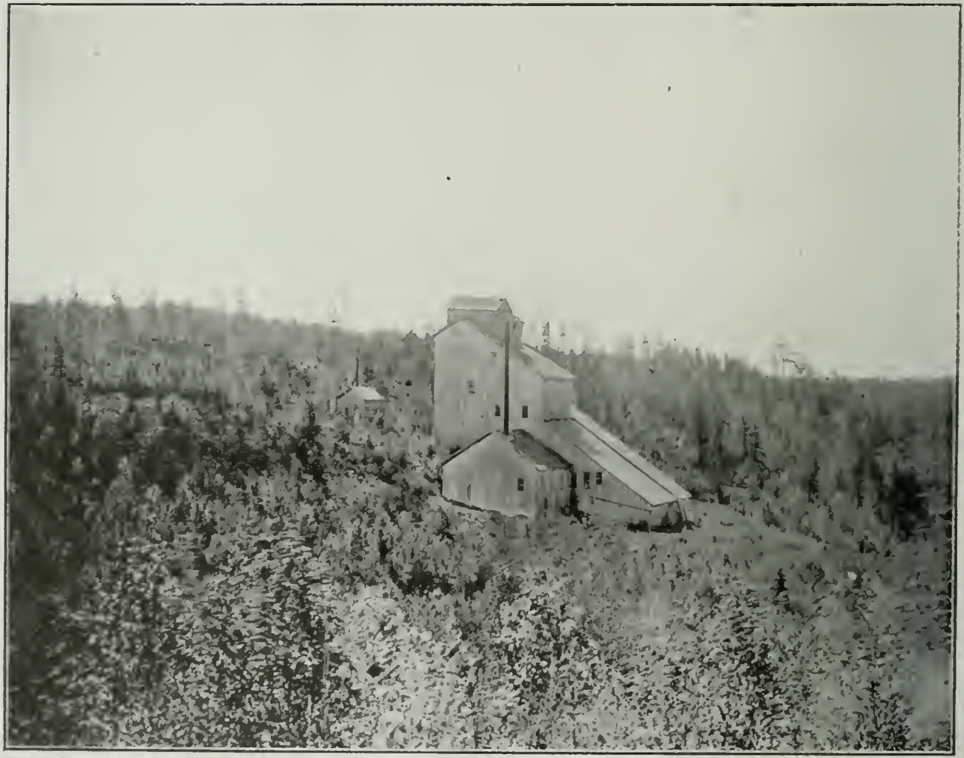


Fig. 25.—Big Master mill, Gold Rock.

Last Chance

During the year work was begun on location S 28 by Messrs. Beck, Kay and Smith, and a promising looking vein of four to eight feet in width has been stripped for a considerable distance and several test pits sunk. Mr. Smith showed some samples of free gold which were said to come from this vein.

Rocks of the Ontario-Manitoba Border

In order to ascertain the point of contact between the Laurentian and Keewatin on the Ontario-Manitoba boundary, a trip was made up the Falcon river to Falcon lake, High lake, West Hawk lake and Ingolf.

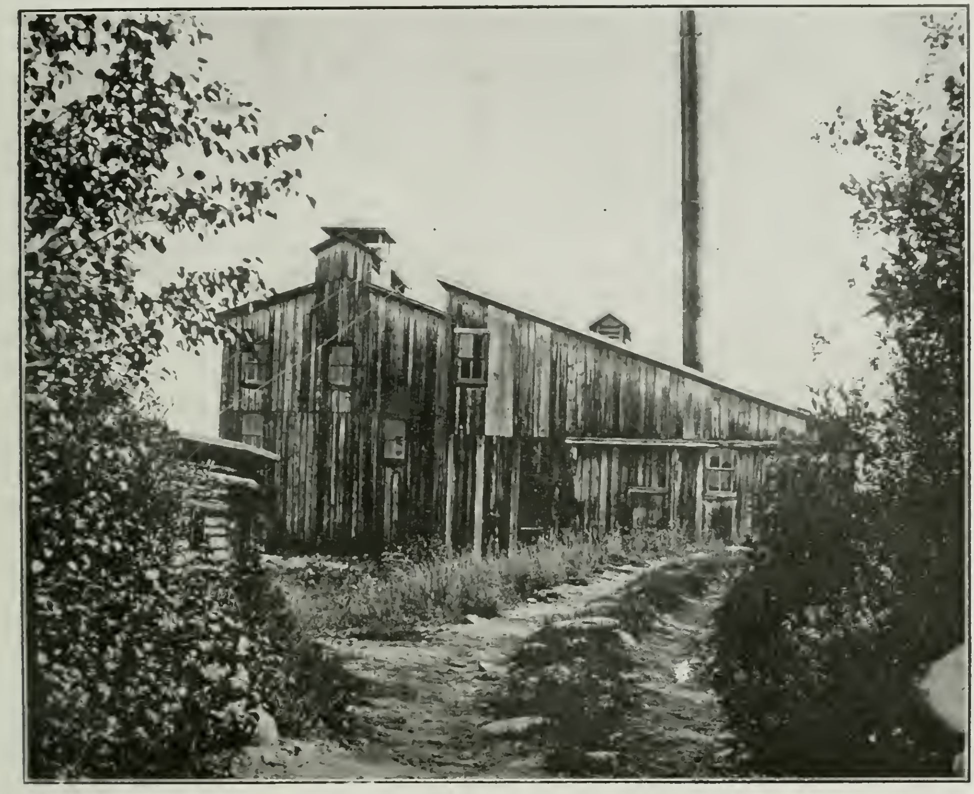


Fig. 26.—Big Master mine, Gold Rock.

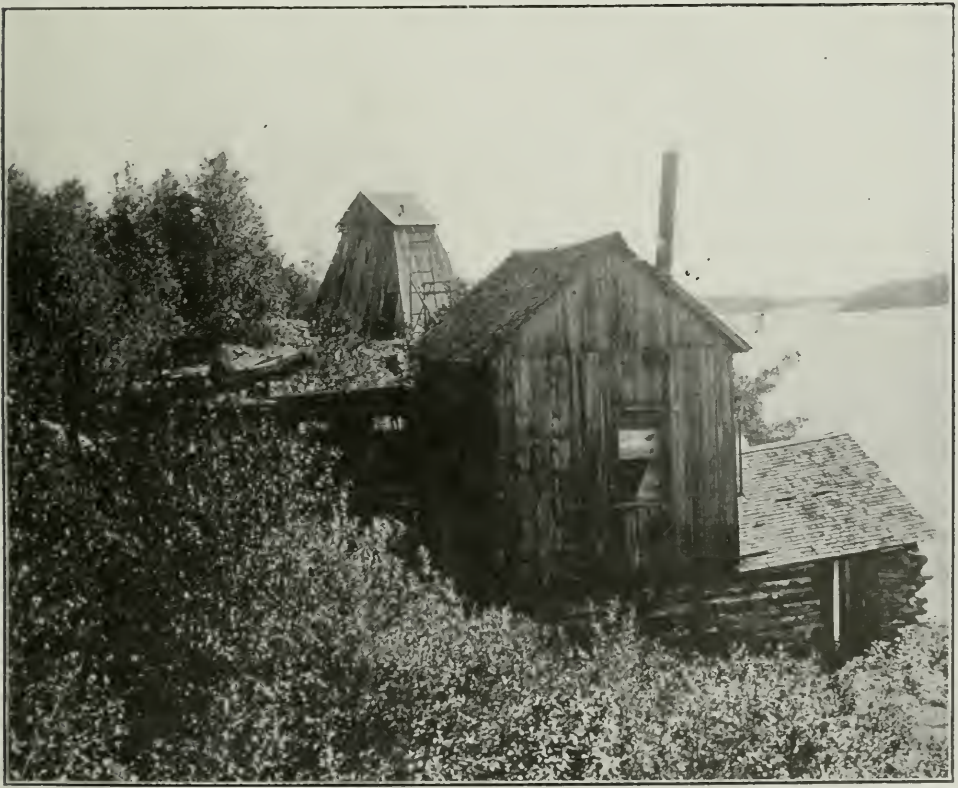
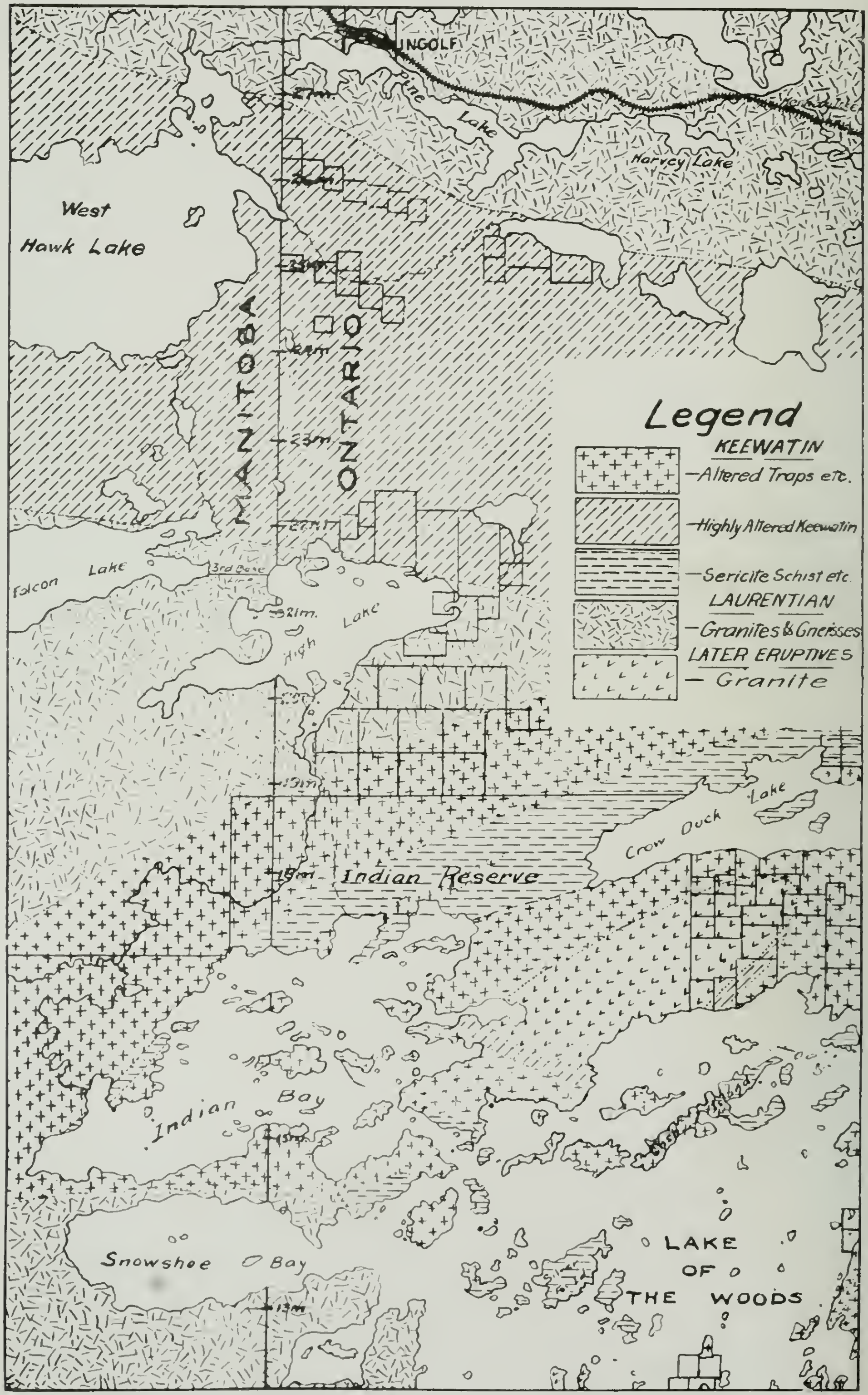


Fig. 18.—Eldorado mine, Eagle lake.



Area Ontario-Manitoba border.

The contact between the altered traps and granite near the south end of High lake was found to be correct, and the rocks surrounding High and Falcon lakes are essentially correct in that they are granites, though the question of the age may still be left open. The north shore of High lake and the extreme northeast end of Falcon lake may be looked upon as a contact zone between the granite and Keewatin. This zone is about a mile in width, as was found by pacing on the boundary line north from High lake, where more than a dozen bands of granite or felsite of varying widths were found in the Keewatin schists.

The Keewatin formation is here about four miles wide, and consists of fine grained highly altered rocks, which show little trace in the field of their origin. The most abundant rock is biotite schist, but hornblende schist is common. Near the contact of this formation with the Laurentian on the north, the rock becomes coarser grained and is almost granitoid in texture, though much darker than the Laurentian gneiss with which it is in contact. The important feature of this formation is the presence of large quantities of pyrrhotite, which are found in three (or more) distinct bands, extending about N. 70° W. In weathering the pyrrhotite gives a peculiar purplish tinge to the rock, which is an easy means of recognizing the pyrrhotite rock.

Fig. 27.—Upper falls, Eagle river.

This pyrrhotite rock is said to contain considerable gold and several shafts have been sunk on the Ontario side of the boundary, while during the past season development has been carried on a little farther west in Manitoba on the westward extension of one of these ranges. The resemblance of these deposits to the higly altered Keewatin rocks north of Dryden is remarkable and they are in all probability of the same age.

As to the question whether they are altered traps or altered porphyries, the bulk of the evidence would seem to indicate that they are principally altered andesite and agglomerates, but it is certain that there is variation in these rocks, and while the most of them are of a decidedly acidic character and preserve to some extent the plagioclase with zonal structure, at places altered diabase is found where the traces of the ophitic texture are to be seen. In much of the rock a large percentage of granular quartz is present, and there is a strong possibility that these are altered sediments. It is certain, however, that part of the series is of igneous origin, but just what proportion is open to doubt. A comparison of the rocks megascopically and microscopically with those of the Dryden iron formation indicates that for the most part they have the same origin. As certain of the rocks seem to be altered diorites or andesites, they are mapped as Keewatin, and are probably a westward extension of the clay slate and agglomerate areas of Woodchuck bay of Lake of the Woods.

Fig. 28.—Middle falls, Eagle river.

The analysis of these rocks confirms the microscopic examination in assigning an igneous origin for the darker rock, while strengthening the supposition that the lighter coloured rocks are sediments. The first analysis is of a light coloured schist at the pyrrhotite workings east of the lake; the second of a dark rock from the point south of the eastern inlet of the lake.

1.		2.	
SiO_2	81.00	SiO_2	60.50
FeO Fe_2O_2	2.53	Fe_2O_3 FeO	3.60
Al_2O_3	10.87	Al_2O_3	22.00

1.—(*Continued.*)		2.—(*Continued.*)	
CaO	0.64	CaO	1.14
MgO	0.14	MgO	0.51
Na_2O	4.46	Na_2O	8.20
K_2O	0.68	K_2O	4.31

It will be seen that the first rock is higher in silica than most igneous rocks, and is probably a sediment, while the second is a diorite or andesite.

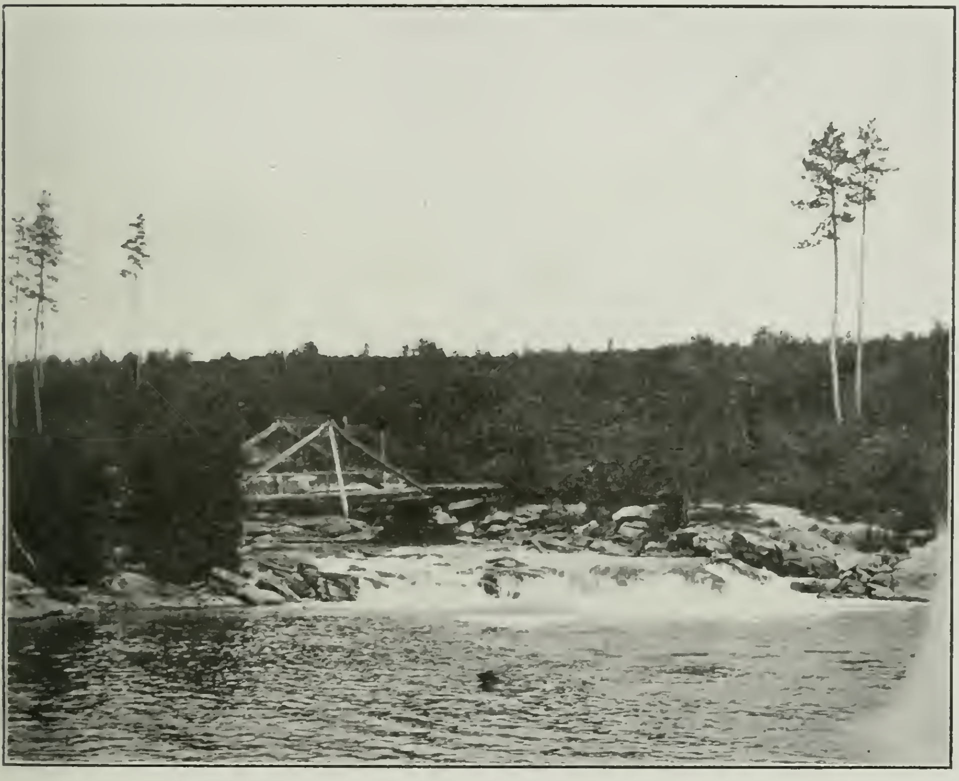
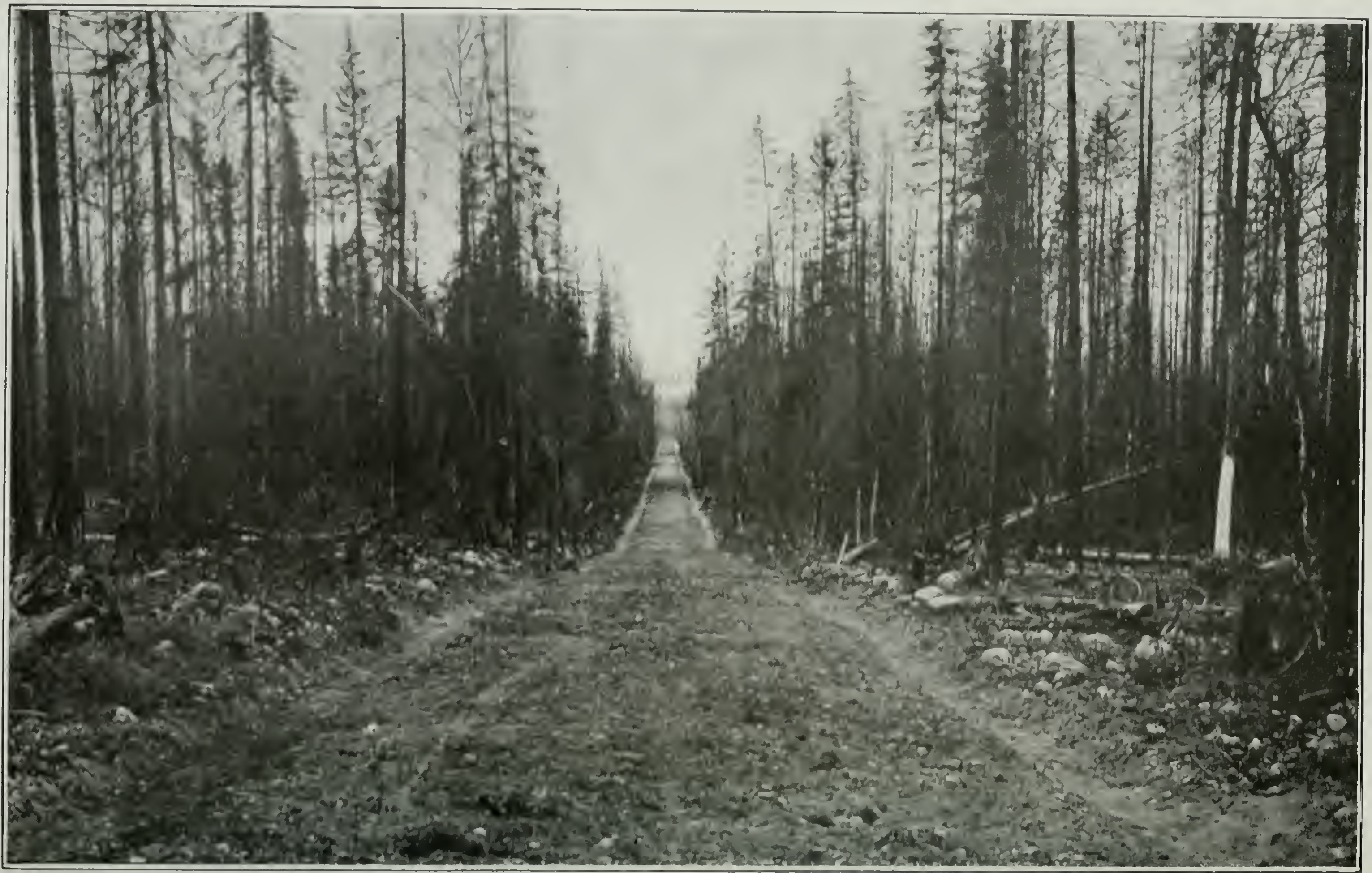


Fig. 29.—Lower falls, Eagle river

Water Power

An undeveloped water power of considerable importance is located at Eagle river, where there are three falls within a distance of a little more than a mile, which should furnish the basis of a profitable manufacturing industry. The total fall is about sixty feet, and large storage capacity is afforded by Eagle lake.

The writer wishes to acknowledge the many courtesies which were shown him in his work. In particular would he express his appreciation to Capt. H. A. C. Machin, M.P.P., whose assistance and hospitality were freely given on numerous occasions. The cordial hospitality of Messrs. F. Pfan, of the Cameron Island mine; J. Taylor, of the Regina mine; J. Hubner, of the Olympia mine; Dryden Smith, of the Detola mine, and D. Hutchinson and A. Hutchinson, of Dryden, in addition to that of many others, is most gratefully acknowledged. The kindness of Mr. Rognon, of Dryden, in putting his launch at the service of the party on several occasions was greatly appreciated. In conclusion, it is the desire of the writer to make acknowledgment of the interested collaboration of his assistants, Mr. D. Freeman, of Bowesville, and Mr. J. Margach, of Kenora.



Government Road, near Frederick House lake.

THE PORCUPINE GOLD AREA

Second Report

By A. G. Burrows

Situation

The Porcupine gold area, which for the past three years has held the attention of the mining public, is situated on the Hudson Bay slope of northern Ontario. The latitude of Niven's First Base Line of 1899, which runs through the centre, forming the south boundary of Tisdale and Whitney, is 48° 27′ 54″; consequently the area is somewhat farther south than the Canada-United States boundary in Manitoba and other western provinces. The camp is in the Temiskaming judicial district. Lying along the southern fringe of the great clay belt of northern Ontario, it adjoins a prospective farming country. In this belt many townships have been laid out in six or nine-mile squares and subdivided into concessions and lots; in the gold area itself and in the adjoining country to the north, many half lots containing 160 acres each have been granted to veterans as homesteads.

During 1911 there was little extension of the gold-bearing area beyond what was known in 1910. The discoveries of Hollinger and Wilson of 1909, now the Hollinger and Dome mines respectively, still remain the most important that have been made, while Tisdale is by far the most important township.

The township of Bristol received much attention in 1911 by the discovery of gold on the McAuley-Brydge claims. Here the gold occurs in a sheared zone of altered sedimentary rock, with included quartz stringers. In the townships of Carscallen and Denton to the west were found some gold-bearing quartz veins in a grey biotite granite. Other areas which attracted prospectors were the townships of Turnbull, Thomas and McArthur.

A geologically colored map, scale one mile to one inch, accompanies this report.

Ingress to the Area

A branch line of the Temiskaming and Northern Ontario railway has been constructed from Iroquois Falls (on the main line), in a southwesterly direction to the town of Timmins, a distance of 33½ miles. Timmins by railway is 485 miles distant from Toronto.

A number of townsites have been established in the area. The most important of these are: Porcupine, South Porcupine and Lakeview, situated on Porcupine lake; Schumacher, on Pearl lake; Timmins, west of Miller lake; and Mattagami, on the Mattagami river.

Elevation of the Area

In elevation the area averages about 1,000 feet above mean sea level. In this respect it is similar to Cobalt, which lies 100 miles to the southeast, south of the height of land. The divide between the Hudson Bay and the St. Lawrence waters is not pronounced, being only about 1,300 feet above sea level.

The highest elevation near Porcupine is along the south boundary of Jamieson, where a felsitic ridge has an altitude of 1,350 feet above sea level.

The country from Night Hawk lake to the Mattagami river is one of low relief. Occasional ranges of hills reach an elevation of 150 feet, but generally abrupt changes in elevation are less than 50 feet. Often in a low area rocks outcrop only a few feet above the surrounding drift and are only a fraction of an acre in extent. Northwest, south, southwest and southeast of Porcupine lake the country is somewhat elevated, and rock exposures are more frequent than in most of the area.

Early Examination of Region

Previous to 1909, the area was little known. There were practically no reports upon it except from explorers and geologists who were attached to survey parties sent out by the Ontario Department of Lands, Forests and Mines.

The main part of the camp is situated along an old portage route, from the Mattagami river to Night Hawk lake, which had been used by the Hudson Bay Company officials for a couple of centuries.

In 1896 Mr. E. M. Burwash examined the country along the Algoma-Nipissing boundary line which was run as far as the southeast corner of Whitney township in that year. He noted the occurrence of quartz veins, carrying traces of gold, at various points on the line. One of these veins he found on what is now the east boundary of Shaw, and only a few miles southeast of the main area. He remarked that the country was a promising one for the prospector but for the drift.[1]

Following the classification of the pre-Cambrian in use at that time Mr. Burwash grouped the Keewatin with the Huronian. He says:—

"In the lower part of the series [now considered to be mainly Keewatin] gold appears to be quite widely distributed both in veins which are of tolerably frequent occurrence and in mineralized portions of the rock itself. In two cases the veins were situated near the boundary of granite areas."

Street scene in South Porcupine, March, 1912.

In 1899 Mr. W. A. Parks reported on the geology of the portage route from the Mattagami river to Night Hawk lake by way of Porcupine lake. He, like Burwash, noted the occurrence of gold in some quartz veins, particularly in the southwest portion of Whitney township, obtaining assays from a trace to $1.00 per ton. In his summary Mr. Parks remarked: "I regard the region south of the trail to Porcupine lake as giving promise of reward to the prospector."[2]

Geological descriptions of areas, including and adjacent to the Porcupine area, are to be found in the reports of the Bureau of Mines for 1903, 1904 and 1905 by Messrs. Kay, McMillan and Kerr, respectively.

In October, 1909, Mr. Jas. Bartlett made a brief examination, for the Bureau of Mines, of the early discoveries of the area.[3]

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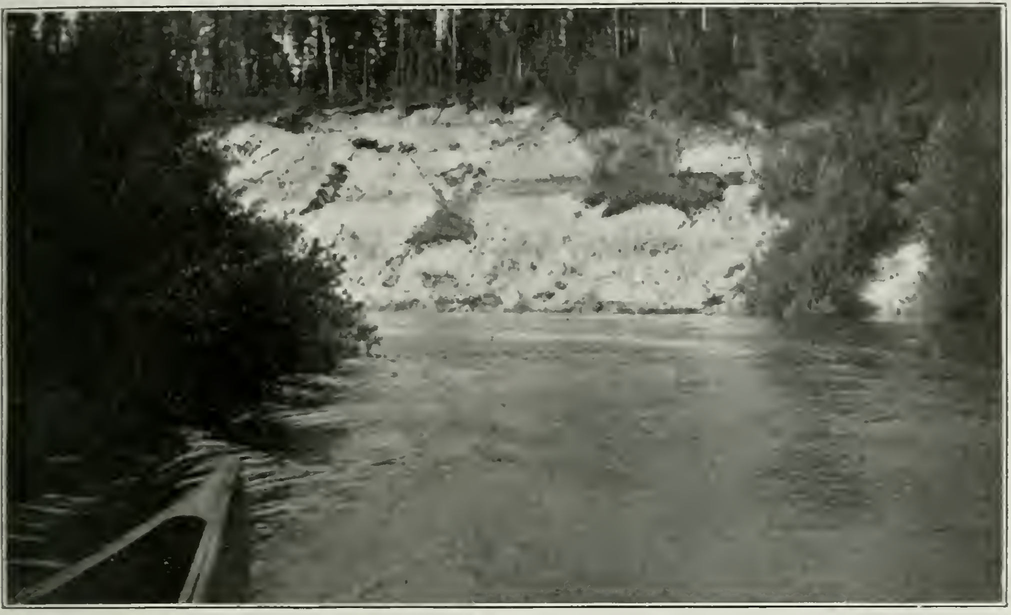
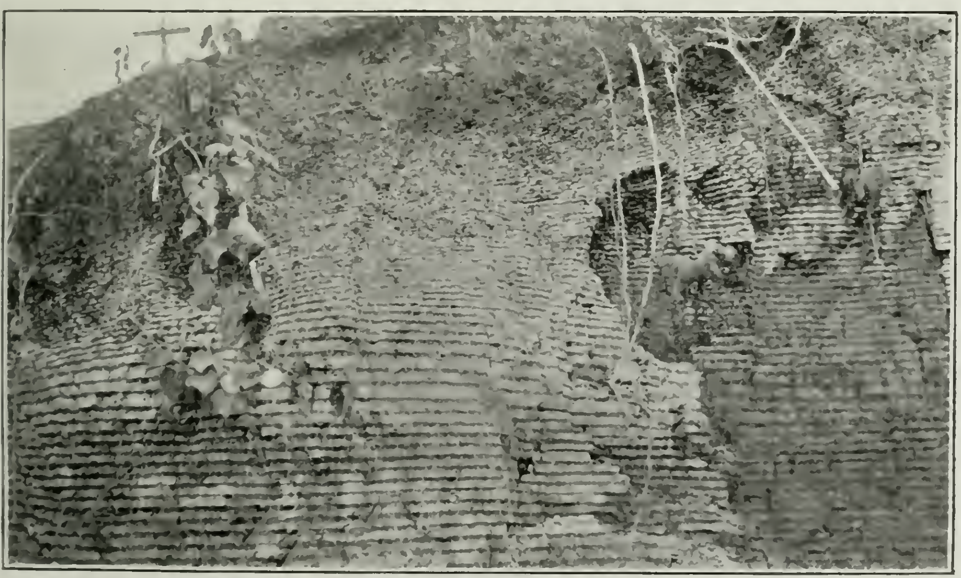
[1] Bur. Min., Vol. VI. (1896). [2] Bur. Min., Vol. IX. (1900). Niven's Base Line. [3] Bur. Min., Vol. XIX. (1910).



Bank 40 feet high of stratified clay overlain by sand. Mattagami river, Ogden township.



Stratified clay at Sandy Falls, Mountjoy township.

The First Prospecting

In 1906 some work was done by prospectors on a vein near Miller lake and a few hundred feet from the present Hollinger vein. Evidently seeing no gold, and having no assays made, they abandoned the property. In the same year claims were staked in Shaw township on what is described in the application as a "vein of sugar quartz and hematite iron." This is of interest since the so-called vein is simply the upturned edges of the Keewatin iron-formation.

In 1908 claims were staked by Mr. H. F. Hunter on the east shore of Porcupine lake in Keewatin formation. Gold was found sprinkled through quartz and schist in a sheared zone.

It was not, however, until the following year that the spectacular discoveries of J. S. Wilson, on what is now the Dome property, caused a rush to the district, and in a few weeks practically all of Tisdale and a great part of the adjoining townships and unsurveyed territory were staked out in mining claims.

Superficial Deposits

The area is for a considerable part drift-covered. These drift deposits consist largely of stratified clays, sands and gravels of post-glacial age; and in addition there are patches of morainic material. Sections of stratified clay, overlain by sand, are well exposed on the Mattagami river, north of Pigeon rapids, and along the shores of Night Hawk lake. Most of the islands in this lake have a rocky shore line, but are capped by stratified material. Where the soil has been removed the rocks are seen to have been intensely glaciated. The fine-grained greenstones have well preserved the scratches and grooves produced by glaciation. On several islands were noted two sets of striations, S. 15° W. mag., and S. mag., the latter of which represents the later ice movement. Owing to the lack of drainage, much of the country, though higher than the rivers and lakes, is very wet, but would be suitable for agricultural purposes if properly drained. For a description of the agricultural possibilities of the country the reader is referred to reports by Mr. A. Henderson.[4]

Forest Fires

During the past two years forest fires have greatly ravaged the area around Porcupine. About the middle of May, 1911, a fire completely destroyed the surface workings and buildings of the Hollinger mine. From that time forest fires were burning in the area until the middle of July. On July 2nd the buildings of the Dome Extension and part of the townsite of Pottsville were destroyed.

The greatest fire of the year occurred on July 11th, when, after a prolonged dry season, a tremendous hurricane from the southwest brought up a fire which did the greatest damage. The surface workings and buildings of the Dome, West Dome, Vipond, Standard, Preston East Dome, North Dome and several other properties were entirely destroyed by fire. The town of South Porcupine was completely wiped out, and almost all the part of Pottsville which escaped the fire of July 2nd. The north part of Porcupine (Golden City) was also destroyed. This fire was attended by a great loss of human life, 71 in all having lost their lives either by being burned, suffocated or drowned.

Timber

In the parts which have escaped the fires there is a dense growth of timber, including white and black spruce, jackpine, birch and poplar. It is interesting to note that a growth of young tamarac is replacing the old tamarac trees, which have all been destroyed in recent years by the larch saw-fly.

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[4] Agricultural Resources of Abitibi, Bur. Min., Vol. XIV, (1905); Agricultural Resources of Mattagami, Bur. Min., Vol. XV, (1906).

Geology

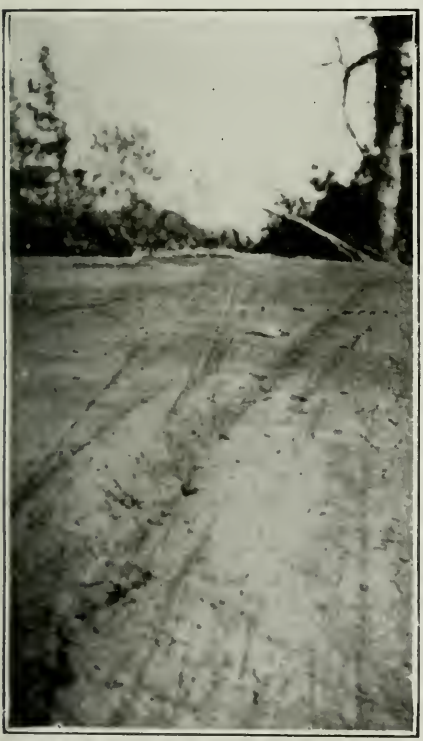
The compact rocks of the area may all be referred to the pre-Cambrian.

Pleistocene

Post Glacial.—Stratified clay, sand, and peat.
Glacial.—Boulder clay.

Pre-Cambrian

Later Intrusives.—Quartz-diabase, olivine-diabase, etc.
Igneous contact.
Cobalt Series.—Conglomerate.
Unconformity.



Glaciated surface, Night Hawk lake.

Ellipsoidal greenstone, Night Hawk lake.

Temiskaming Series.—Conglomerate, quartzite, greywacké, slate or delicately banded greywacké.

Unconformity.

Laurentian.—A complex of granites older than the Cobalt series. It intrudes the Keewatin, but its relationship to the Temiskaming is not definitely known; it may be in part older and in part younger than the Temiskaming series.

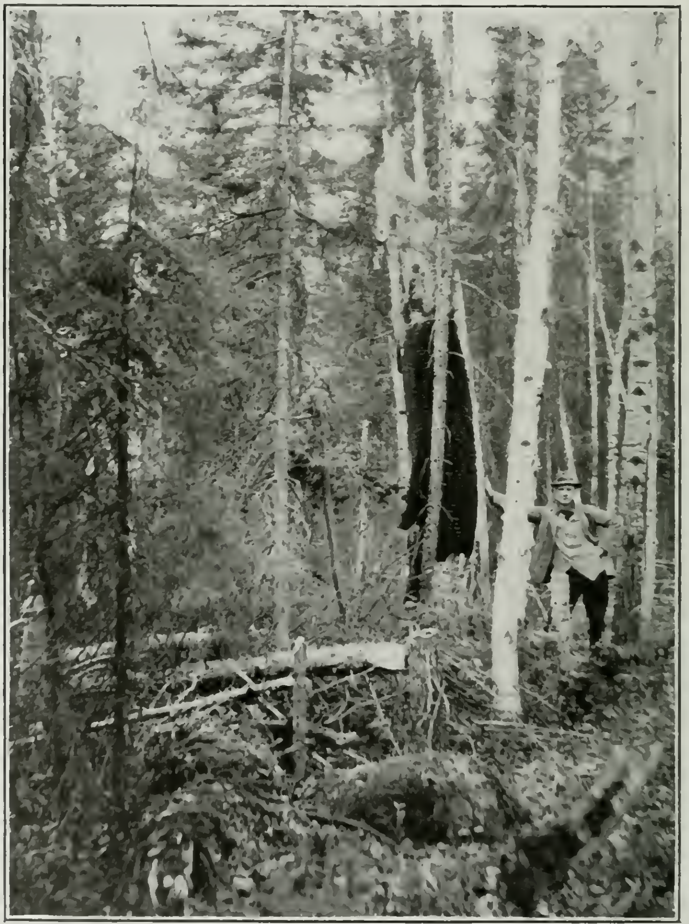
Igneous contact.

Keewatin.—The series consists chiefly of basic to acid volcanics, much decomposed, and generally schistose; amygdaloidal basalts, serpentine, diabase, quartz, or feldspar, porphyry, felsite iron formation and rusty weathering carbonates, and other rocks have been recognized.

Keewatin

The Keewatin has a much greater distribution in the Porcupine area than the other members of the pre-Cambrian, and it is also of more importance economically, since it contains the greater number of the gold-bearing veins which have so far been discovered.

As in other parts of Ontario the series is highly metamorphosed, and many rocks are so much altered as to give little evidence of their original character. However, much of the series can be seen to consist of basic and acid volcanics such as basalts and porphyries, with intermediate types, although these are often altered to schists. Where schistose, the general strike over a considerable area is found to vary from east and west to northeast and southwest, while the dip is generally steep to the north.



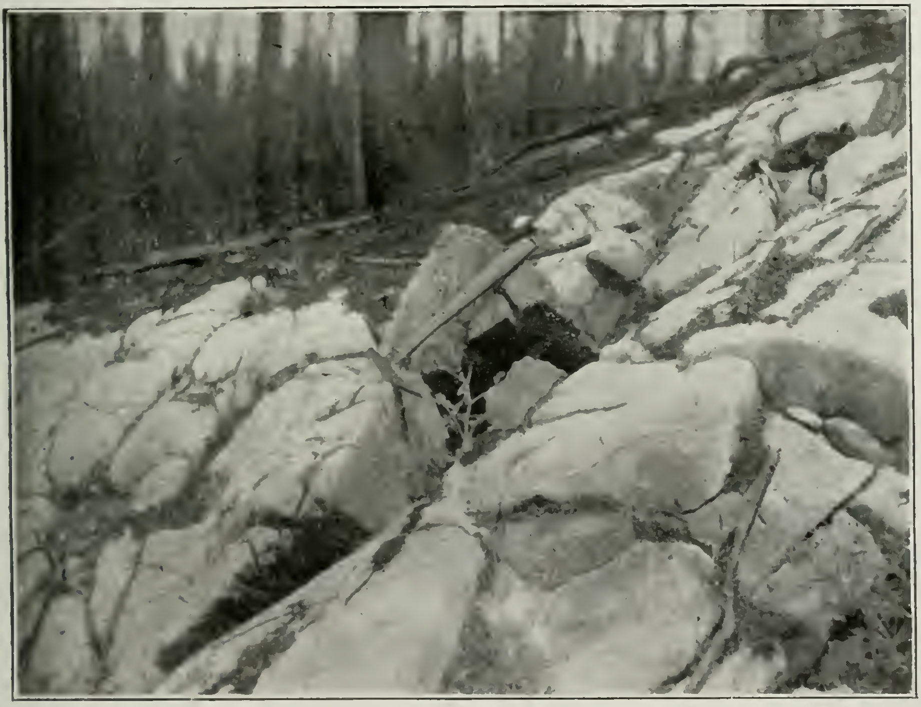
Relics of fire at Porcupine over 50 years ago. Note spruce tree growing through old black stub (red pine), Oct. 1911.

Among the more massive rocks are greenstones (basalts, etc.), which frequently show a striking ellipsoidal or pillow structure. Amygdules often accompany this structure and occur most abundantly along the rims of the ellipses. The centres of the ellipses are often bleached to a light greenish or whitish colour, whereas the margins are considerably darker. This structure is frequently seen in the northwest part of Whitney township. It is very pronounced in the greenstone along the shores of Night

Hawk lake and on the islands in this lake. On the main land, opposite Callinan's island in Night Hawk lake, the ellipsoidal greenstone has been rendered quite schistose, so that the structure appears as alternate light and dark bands. Some of the greenstones have been brecciated and resemble conglomerate.

Serpentine occurs in parts of the area in large volume. The range of hills immediately southeast of Porcupine lake are largely composed of this rock, which is impregnated with much carbonate. Occasional veinlets of fibrous asbestos are seen. A section of a sample of serpentine rock from the southeast shore of Porcupine lake is made up largely of fibrous serpentine, together with residual iron oxides, which in arrangement suggest original crystals like olivine. The remainder of the rock is dolomite. A chemical test showed the absence of chromium oxide in this rock.

Serpentine rock, carrying veinlets of asbestos, occurs in Deloro township on H. R. 968. Some of the serpentine is plentifully seamed with narrow veinlets of asbestos of good grade, and if the mineral-carrying serpentine is in quantity, it might be worthy of investigation as a source of asbestos. A similar rock occurs in the southeast part of Eldorado township.



Serpentine rock with veinlets of asbestos, south part of Deloro township.

The rock from the boundary between Whitney and Tisdale, about the middle of the fourth concession, is a fine-grained amphibolite, consisting essentially of hornblende, epidote, zoisite and calcite.

The rock from the main shaft of the Davidson is dark green in colour and shows blades of dolomite. In thin section the groundmass appears to be largely composed of chlorite, through which are numerous feldspar rods. In the groundmass are scales of sericite, grains of quartz and numerous large crystals of dolomite. Much of the greenstone along the veins of north Tisdale is greatly altered to impure carbonate rock, but in the sample just mentioned an igneous texture is quite distinctly recognized and the rock is considered to be an altered basalt. A similar rock to this occurs south of the power house at the Crown Chartered, the adjoining property.

A greenstone, north of the quartz-ankerite veins on the Gray claims in Ogden township, which shows a rough ellipsoidal structure, is very similar to the rock from the Davidson.

A spotted rock, from the northeast part of the West Dome in lot 5 in the first concession of Tisdale, is probably an altered amygdaloidal lava. The schistose matrix consists of secondary material, dolomite, sericite, etc., and the amygdules, whose margins are stained with limonite, are filled with calcite, sericite, and quartz. Some of the amygdules are an inch in length.

An amygdaloidal rock from the 100-foot level of the Vipond mine is entirely decomposed. The amygdules are now stained with red iron oxide and show much clear calcite. Rims of chlorite surround the amygdules, along which are scattered grains of magnetite. There are also some minute grains of a secondary mineral, quartz or feldspar.

A sample from the main shaft at the Dome Extension is quite schistose in thin section. Rods of plagioclase can still be recognized, while the ferro-magnesian mineral is entirely altered to chlorite. Quartz is present in small grains, and calcite is abundant in grains. Secondary feldspar is present in the form of clear grains. The rock may have been a diabase or basalt, but is now much altered.

A chemical analysis of this rock gave: Silica, 49.88 per cent.; alumina, 15.29 per cent.; ferric oxide, 0.43 per cent.; ferrous oxide, 11.30 per cent.; lime, 4.54 per cent.; magnesia, 7.83 per cent.; soda, 2.17 per cent.; potash, 0.62 per cent.; carbon dioxide, 3.20 per cent.; water, 5.17 per cent.

The light-coloured more massive rocks are principally quartz-porphyries and felsite, which in places intrude the more basic rocks. When the porphyry occurs in some volume, as around the Hollinger mine, the name rhyolite has been applied to it. Much of the porphyry has been altered to a sericitic schist, and frequently a rather massive rock can be traced into a very schistose one. This change can be well seen in the porphyry to the southwest of the Dome mine workings. A porphyry from the south half of lot 4 in the first concession of Tisdale, examined in thin section, shows the phenocrysts to be largely plagioclase feldspar, while quartz in rounded grains is also present. The groundmass is made up principally of plagioclase feldspar and quartz. Laths of tourmaline are scattered through the rock.

The schist at the surface and at 50 feet in No. 1 shaft of the Hollinger mine, is fine in grain and of a light gray color when fresh. The groundmass consists essentially of sericite (or talc), dolomite, quartz and feldspar. In this occur round and irregular eyes of quartz which may represent phenocrysts in the original rhyolite or quartz-porphyry from which the schist has probably been derived. Cubes of iron pyrites are commonly set in the rock. Other thin sections from the gray schists on the Timmins properties have about the same group of minerals, and most of them effervesce with hydrochloric acid.

The somewhat massive rhyolite exposed just southeast of Miller lake is made up of a fine-grained matrix of quartz, feldspar and sericite in which are set small phenocrysts of quartz and feldspar. The rock is much impregnated with dolomite.

A sample of schistose rock from the 140-foot level of the Bewick-Moreing shaft, east of Pearl lake, shows an abundance of sericite, chlorite and calcite, with numerous quartz grains. The rock is entirely altered, but some of the quartz grains may be remnants of phenocrysts.

A sample of schistose quartz-porphyry from south of the Dome mine workings shows phenocrysts of quartz and feldspar in a fine-grained groundmass of these minerals. The extinction angle of some of the feldspar phenocrysts is near that of oligoclase-albite. Sericite scales are often grouped around the crushed feldspar crystals and have penetrated them. Cubes of iron pyrites are abundant.

In addition to the quartz-porphyry there are numerous dikes of a gray feldspar-porphyry. These are generally less than 100 feet in width, and south of Porcupine lake on the Edwards claim intrude the schistose quartz-porphyry. One such dike of feldspar-porphyry on H. R. 1,043 in Deloro township has been prospected for gold. The dike is intersected with minute stringers of quartz in which most of the gold occurs. A thin section of the rock shows the phenocrysts to be an acid plagioclase which is fairly fresh, but is partly invaded by scales of sericite. Plagioclase is also prominent in the groundmass.

Two analyses of quartz-porphyries gave the following composition:—

—	(1)	(2)
Silica	65.22 per cent.	67.64 per cent.
Alumina	14.62 "	18.68 "
Ferric oxide	3.39 "	1.80 "
Ferrous oxide	1.14 "	1.38 "
Lime	3.01 "	0.39 "
Magnesia	1.09 "	1.04 "
Soda	5.66 "	4.16 "
Potash	1.45 "	1.61 "
Carbon dioxide	2.61 "	trace.
Water	1.07 "	1.92 "
Sulphur	0.79 "	1.71 "

(1) Quartz porphyry from No. 2 shaft, Preston East Dome.
(2) Schistose quartz porphyry, south of Dome mine.

At times the Keewatin has been much crushed and broken, so that the rock has the appearance of a conglomerate; so much so that in the vicinity of the Dome mine, where greywacké and conglomerate occur, it is impossible to draw a close line of distinction between the autoclastic rock and the true conglomerate.

Iron Formation

Banded iron formation, grouped with the Keewatin, has an extensive development in parts of the area. It outcrops frequently in the southwest part of Whitney township in the first and second concessions. The disturbance in the formation here has not been so great as in other parts. Often the bands are lying almost horizontally. In places they have been somewhat brecciated, but otherwise little disturbed. The bands are alternate reddish or grayish sugary quartz and magnetite or hematite. Sometimes the narrow bands of magnetite, one-eighth inch thick, carry a merchantable percentage of iron, but these are relatively subordinate in comparison with the main mass of rock. It is unlikely that merchantable iron ore will be found in quantity. In parts of the formation iron pyrites replaces the magnetite. Almost horizontal, interbanded iron pyrites and silica are seen on the south half of lot 5 in the second concession of Whitney. A sample of banded quartz and iron pyrites gave 40 cents in gold per ton. Iron pyrites occurs in considerable quantity with a sugary quartz on lot 9 in the second concession, and and might be worthy of investigation as a source of sulphur.

In Deloro and Shaw townships the iron formation is more highly tilted—generally from 60° to nearly vertical. Bands can be traced for several miles in a direction somewhat south of west. In this position, and especially where the iron ore is deficient, the formation greatly resembles wide quartz veins, and many prospectors have done considerable stripping and prospecting along it. The formation is frequently cut by quartz veins in which visible gold sometimes occurs. In most cases the prospector has considered the iron formation itself to be a quartz vein or dike, and low gold values have been obtained from some of this material, especially where secondary iron pyrites is present.

Carbonate Rocks

In various parts of the area associated with Keewatin rocks are carbonates to which various terms have been applied, such as: dolomite, ferro-dolomite, ferruginous carbonate and ankerite.[5]

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[5] The name "ferro-dolomite" is not recognized by Dana and other authorities.

There is much uncertainty as to the origin of this rusty carbonate rock in different parts of the area. The carbonate may occur in at least four different forms, namely, as original bedded material, as a replacement, as vein filling, and as a decomposition product of basic, igneous or other rocks.

Dr. W. G. Miller, in his notes with the first edition of the Porcupine map, states that certain dolomites of the area may correspond to the crystalline limestone of eastern Ontario. Further he says: " It would appear not unlikely that carbonate in some places is a replacement mineral, and that a considerable volume of rock may at times have been replaced by carbonate."

In the township of Deloro there are bands of carbonate closely associated with bands of iron formation which may be traced for several miles in an east-west direction. The relationship would suggest a similar origin for these rocks, that is, as beds deposited in sea water and now resting in an inclined position dipping to the north. These dolomite bands are frequently intersected with quartz veinlets, carrying some gold values, hence their importance. The bands have recrystallized and carry veinlets of later carbonate, as well as quartz.

In the northeast part of Tisdale and the adjoining part of Whitney, there is considerable rock which carries a high percentage of carbonate. This impure carbonate rock is much fissured by quartz veins, as on the Armstrong-McGibbon, lot 1 in the fifth concession of Tisdale, and other properties in the vicinity.

Several samples of rock which effervesce strongly with acid show an original igneous structure under the microscope. A sample from near one of the Davidson veins on the southwest quarter of the south half of lot 2 in the fifth concession of Tisdale is a medium-grained, greenish, much altered igneous rock. Plagioclase feldspar, showing albite twinning, may still be recognized, and also micrographic intergrowths of quartz and feldspar. The remaining minerals are secondary—chlorite, calcite, etc., and make up a large part of the rock, which is probably a quartz-diorite or grano-diorite. Another rock, taken from a cross-cut at 90 feet depth, on the Scottish Ontario property, is an altered basalt. The plagioclase feldspar is largely altered to saussurite minerals, while the ferro-magnesian mineral has gone to chlorite, and magnetite to leucoxene. Calcite is present in considerable quantity as a secondary mineral. Other examples could be cited showing the replacement of igneous rock by carbonate. It is believed that this process has continued in some cases to such an extent that the rock is now largely carbonate, while the original rock constituents are leached out, or so altered as to show little trace of the igneous origin.

Analyses were made of some impure carbonates which occur with the quartz veins in northeast Tisdale, with the following results:—

—	1.	2.	3.
	Per cent.	Per cent.	Per cent.
Insoluble	51.82	58.63	47.35
Calcium carbonate	19.38	19.59	20.98
Magnesium carbonate	6.08	8.06	8.50
Ferrous carbonate	13.49	11.53	12.19

No. 1 is an impure carbonate from near the west end of the main quartz vein on the Davidson claim, N.W. ¼, S. ½, Lot 2, Con. 5, Tisdale.

No. 2 is from the south wall at the east end of this vein and is quite schistose.

No. 3 is from the Crown Chartered property—just northwest of No. 1 shaft.

Similar impure carbonates occur at the Armstrong-McGibbon, Scottish Ontario and other properties near by, and also in other parts of the area—as at the Rea vein, lot 6 in the third concession of Tisdale. Microscopic examination of the above rocks shows them to be entirely secondary. There is an abundance of sericite and a minor quantity of quartz present in the sections.

That there has been considerable migration of carbonate solutions is shown by the manner in which almost all the rocks of this area are more or less impregnated with it. Sections of quartz-porphyry schist show the presence of much calcite as a secondary mineral. Veins and veinlets of ankerite occur frequently, not only in basic rocks, but in the quartz-porphyry.

The origin of some of the ankerite bands, such as are seen in the Curts "vein" on the West Dome properties is difficult to explain. Analyses of samples of this ankerite show it to be almost free from insoluble impurities, in which respect it is quite different from the carbonate occurring in northeast Tisdale. The distinct walls of the band of carbonate suggest a vein or bed origin for it rather than a replacement. Analyses of carbonate from different parts of the Curts vein are given in columns 1 and 2.

Looking west along the ankerite lode on the West Dome property.

—	1.	2.	3.	4.
	Per cent	Per cent.	Per cent.	Per cent.
Insoluble............	1.73	....	11.42	....
Calcium carbonate....	50.63	51 28	46.63	42.76
Magnesium carbonate.	29.57	29.82	28.77	19.86
Ferrous carbonate	11.15	11.70	5.39	12.01

No. 3 is an analysis of ankerite from a narrow vein on the east Foster claim (West Dome).

No. 4 is an analysis of a very dark gray ankerite from a vein on the Gray claim, Ogden township.

The impure carbonates may have resulted in some cases from a direct alteration of basic dikes. What is known as the Powell carbonate band, on M. E. 20 in Deloro township, contains considerable serpentine and a chrome mica which could well come from a chromiferous peridotite. In the south part of the same township, on P. P. 57, there is a carbonate rock which is about 100 feet wide. It consists principally of carbonate and serpentine, through which ramify many veinlets of almost pure magnesite. All these minerals are cut by veinlets of quartz. An analysis of the magnesite gave: $CaCO_3$ 0.48; $MgCO_3$ 80.25; $FeCo_3$ 2.46. Robert Harvie ascribes such an origin for the rusty carbonate bands of the Opasatica lake area in Quebec.[6]

On the other hand it is likely that a great number of the almost pure ankerite veins of the area have been formed from circulating waters as suggested above.

Similar Rocks in Other Areas

Carbonate rocks are characteristic of all the gold-bearing areas of northern Ontario.

Larder lake, which lies about 70 miles east-southeast of Porcupine, is referred to by Mr. R. W. Brock as follows:

" The most interesting rock from an economic standpoint near Larder lake is a rusty weathering dolomite (?). About 60 per cent. of the rock consists of lime-magnesia—iron carbonate, the remainder of quartz and a soft green talcose silicate; probably serpentine. The origin of the rock is as yet a little uncertain. Certain dikes, when squeezed and altered, produce a rock which bears a strong resemblance to it, but its occurrence with slates and phyllites and with the cherts—undoubted sedimentary rocks—as a conformable band . . . render it more probable that it is an altered stratified ferriferous dolomite, probably forming a member of the iron ore formation. This rock, especially where cut by the porphyry or pegmatite . . . . is traversed by innumerable stringers of quartz which in places are gold-bearing.[7] "

Mr. Morley Wilson also refers to Larder lake, and to Opasatika lake to the east, as follows:

" In the neighbourhood of Larder lake and north of lake Opasatika are local outcrops and bands of a rusty-weathering rock consisting of ferruginous dolomite or ankerite, with varying quantities of quartz and feldspar. It is always highly pyritic, and in most localities contains a large amount of chrome mica or fuschite from which the rock derives its color. As a rule the rock is cut in a most complex manner by two or more sets of veinlets of quartz or of quartz and ferruginous dolomite, the dolomite occurring along the margin of the veinlet and the quartz in the centre.[8] "

M. B. Baker describes a similar carbonate rock in his report on the Abitibi lake area,[9] and also A. A. Cole in his report on the gold-bearing deposit at Gold island in Night Hawk lake.[10]

Some of the gold deposits on Temagami lake are associated with the carbonate.

W. G. Miller refers to these in his report on " The Iron Ores of Nipissing District ":

" At Ferguson point a pit has been sunk in quartz and dolomite. The appearance of these two minerals in association is interesting as the mixture of the two resembles closely the gangue of some of the auriferous mispickel ore bodies in Hastings county. There are some other masses of more or less silicious dolomite along this (northeast) arm of Temagami, in Emerald lake and elsewhere.[11] "

A. L. Parsons describes a carbonate as occurring at the Regina mine, Lake of the Woods:

" No. 3 vein is principally quartz, though in places a good percentage of a rusty carbonate is found intermingled with the quartz. The west vein, which is about 20 feet wide, consists of two parts, that upon the north being quartz interbanded with rusty carbonate, while the southern portion consists entirely of this rusty carbonate.[12] "

In the same area at West Shoal lake, A. P. Coleman describes the veins at the Oliver Daunais location as quartz mixed with a good deal of dolomite. In some cases the latter mineral contains a few specks of free gold.[13]

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[6] Journal of Canadian Mining Institute, Vol. 14. p. 187. [7] Bur. Min., Vol. XVI. (1907), p. 207. [8] Sum. Rep. Geo. Sur. Can., 1909. [9] Bur. Min., Vol. XVIII. (1909), p 270. [10] Ibid., Vol. XVI. (1907). p. 220. [11] Ibid., Vol. X. (1901). [12] Ibid., Vol. XX. (1911) [13] Ibid . Vol VI. (1896), p. 105.

Carbonate rocks are also associated with iron ore deposits in northern Ontario, as at Helen mine, Michipicoten. In this locality there are masses of siderite impregnated with iron pyrites, from which, according to A. P. Coleman, the hematite ore has been derived.[14]

It will be seen that the carbonate rocks of the pre-Cambrian have a wide distribution in Northern Ontario. They vary considerably in composition, but are represented for the most part by crystalline limestone in which $CaCo_3$ predominates. Other carbonates are ankerite, siderite and dolomite. In one locality the crystalline carbonate has the composition of magnesite.

A strikingly green colour is often seen in the ferruginous carbonate rocks of the area. It is well shown in these rocks on Night Hawk lake. N. L. Turner, Provincial Assayer, obtained decided reactions for chromium in a sample from Night Hawk lake, suggesting the presence of a chromium silicate. Mr. Morley Wilson describes a similar green mineral from Opasatika lake as a chrome mica or "fuschite."

A similar mineral has been reported to occur on lake Abitibi and elsewhere.[15]

A chrome-magnesia mica (biotite) occurs in the township of Hyman, Algoma district.[16]

Fragmental Rocks

At the lower end of the third sandy portage on the Mattagami river below Timmins' landing, the rock is now schistose, but is made up of bands of coarse and fine material which tail out like sedimentary deposits. This rock, however, may be composed of volcanic fragmental material which has been water-sorted.

At the middle and upper sandy portages, the rock has a fragmental appearance in the field, but Mr. C. W. Knight, from an examination of thin sections, suggests that such rocks may have been originally quartz-porphyry, which is now much crushed and impregnated with carbonate. One sample contains somewhat rounded grains of quartz and feldspar in a fine interlocking matrix of quartz and feldspar, with sericite and calcite.

On the south boundary of Jamieson in lot 7, about 4 miles northwest of Sandy Falls, there is a volcanic rock, now somewhat schistose, but the porphyritic character of which is distinct, with phenocrysts of clear quartz in a dense gray felsitic groundmass. The rock described at Sandy Falls may be similar to this, but more highly altered.

Laurentian

A few outcrops of granite occur in the township of Whitney. This granite is a medium-grained biotite variety, and not typical of that occurring in large volume to the north and south of the area. In south Whitney it includes light-coloured porphyry of Keewatin age, but its relation to the Temiskaming is not known.

About 40 miles north of the gold area there are frequent outcrops of granite and gneiss. The known outcrops of rock immediately to the south are mainly of Keewatin age. Granite occurs on the Mattagami river just north of Loon portage, and the contact runs to the eastward, crossing the Frederick House river south of Neeland's rapids, and thence southeasterly to near Iroquois Falls on the Abitibi. To the north of these points for some miles the rock exposures are largely granite or gneiss.

Again, granite occurs on the Mattagami river south of Wawaitin portage, which is southwest of Porcupine. There are also outcrops of this rock along the south boundaries of Price and Adams in association with basic Keewatin rocks, which they intrude partly as narrow dikes. The granites are largely of a flesh-colored hornblende, biotite variety. The only gneissoid structure observed is a paralleling of the constituent minerals. Some of the granite is porphyritic with phenocrysts of pink feldspar up to two inches in length.

A striking hornblende granite with crystals of pink feldspar up to an inch in length occurs along the south boundary of Blackstock. It is similar to granites found in Mc-

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[14] Bur. Min., Vol. X. (1901), p. 193.
[15] Ibid., Vol. XVI. (1907), p. 219.
[16] Rep. Geol. Sur. Can., Vol. VI. (1892-3), p. 27 R.

Arthur and Fripp, and is likely of the same age. In thin section the rock is made up of a flesh-coloured orthoclase as the most prominent constituent, with lesser amounts of microcline and acid plagioclase. The ferro-magnesian constituents have been altered to chlorite. The quartz is in small grains, some of which are enclosed in the porphyritic orthoclase and acid plagioclase.

A reddish variety from the east boundary of Fripp township is a hornblende granite, showing in thin section quartz, albite, hornblende, apatite and titanite. The hornblende is partly altered to chlorite.

In the township of Denton, about 30 miles southwest of Porcupine, a gray biotite-granite intrudes Keewatin greenish and grayish schists. Gold-bearing veins have been found in both the Keewatin and in this gray granite rock, so there may be some relationship between these quartz veins and the gray granite. A reddish hornblende granite occurs in the same township, but its relation to the biotite granite is not apparent.

There are a number of quite fresh reddish acid dikes in the area which may belong to the Laurentian.

One such dike rock is seen on the Thomson claims in Bristol township. It consists essentially of feldspar and quartz. Zonal structure is well shown in the porphyritic feldspar of which the nuclei are often prisms of feldspar. Microcline and quartz are abundant.

A red dike from the Pettipher claim in Thomas township is a granophyre with porphyritic feldspar in a granophyric groundmass.

Another red dike, which is quite fine-grained, occurs on a small island just south of Gold island, in Night Hawk lake. This rock is composed almost wholly of albite. Calcite is scattered through the rock in minute rhombs and there are numerous cubes of pyrite. Occasionally the rock is porphyritic, showing phenocrysts of albite.

These dike rocks are frequently intersected by very small quartz veinlets which sometimes carry gold, while gold values have also been obtained in the dike rock.

A sample of Night Hawk lake dike, not showing any quartz veinlets, gave an assay of $1.80 per ton in gold.

The small veinlets in these rocks are very suggestive of the filling of cooling cracks in the dikes with material which may have been derived from the same magma.

The chemical composition of these acid dikes is given in the following table:—

	1.	2.	3.
	Per cent.	Per cent.	Per cent.
Silica	65.42	69.28	59.42
Alumina	15.80	15.53	17.86
Ferric oxide	2.75	2.88	3.46
Ferrous oxide	0.91	0.69	1.59
Lime	1.33	2.15	2.61
Magnesia	0.53	0.93	1.15
Potash	6.26	0.25	0.60
Soda	5.18	7.16	9.60
Carbon dioxide			2.01
Water	2.46	1.44	0.43
Sulphur			1.66

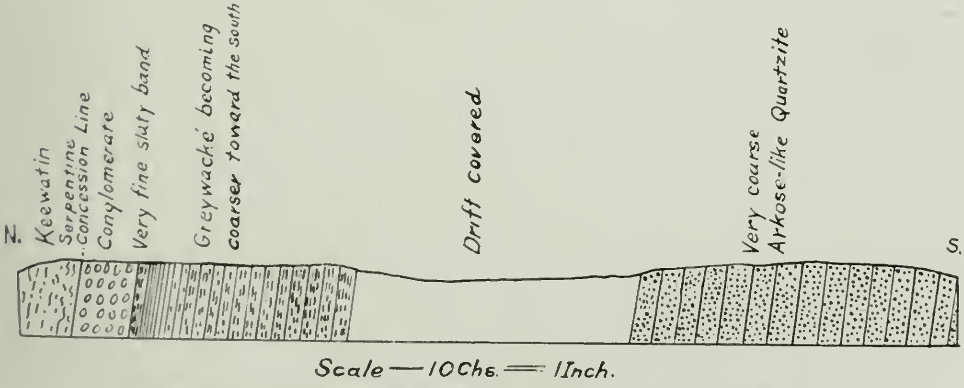
1. Granite-porphyry dike, Thompson claim, Bristol township.
2. Granophyre, Pettipher claim, Thomas township.
3. Felsite, from small island south of Gold island, Night Hawk lake.

While typical granites do not outcrop in the immediate vicinity of Porcupine, they occur in large volume to the north, west and south of the area, and are known to intrude the Keewatin. Where the granites are exposed over large areas they are medium to coarse in grain, and have been exposed at depth by extensive erosion. It is considered that the granophyre, porphyry and felsite rocks are dike representatives of the granites, which very likely underlie the Keewatin and Temiskaming formations at Porcupine. The predominant feldspar of the acid dikes is a plagioclase (near albite), which is also prominent in many of the granites.

Pre-Cambrian Sedimentary Rocks

Geological work in the area during 1911 showed that there are at least two sedimentary series which are later in age than the Keewatin. The older of these has been called the Temiskaming, and the younger Cobalt, corresponding to similar rocks in the

Crumpled rocks at base of sedimentary series on the south part of Dome property, Sept. 1911.



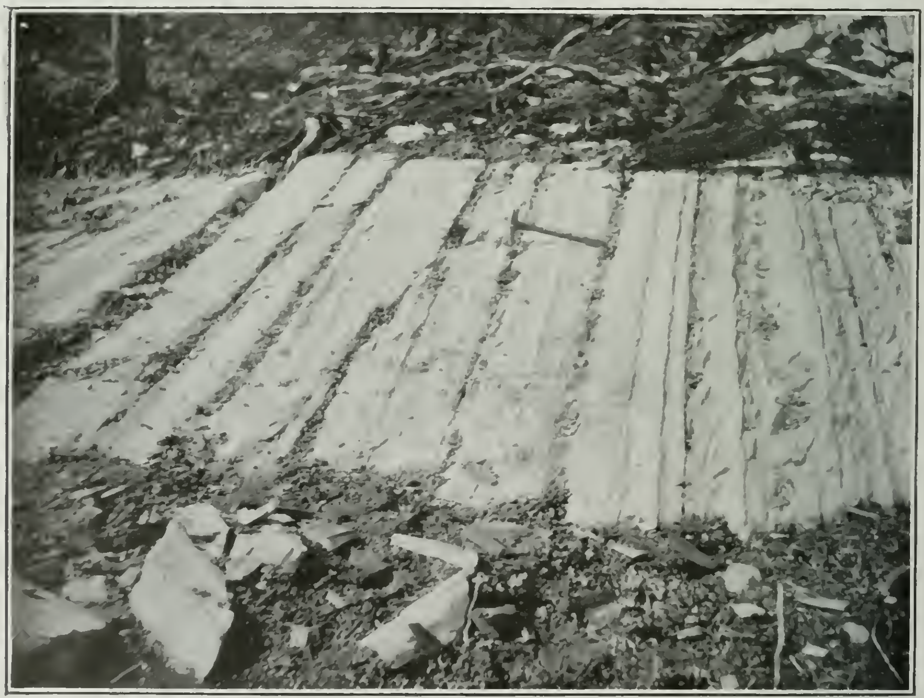
Section of the Temiskaming series in lot 5, con. 5, Whitney township.

Cobalt district. At Porcupine the Temiskaming series is of great economic value, since several important veins have been found in it.

The largest area of fragmental rocks stretches from the Dome mine in a northeast direction for about ten miles. It consists of a series of slate, quartzite and conglomerate which has generally been greatly disturbed. The beds have been highly tilted, dipping at angles from 70° to vertical. A secondary cleavage has been developed in many parts, and the rocks have been rendered quite schistose. The general direction of the strike is from N.E.-S.W. to E.-W. In this respect the series is related to the Keewatin which has a corresponding strike. It is evident that much of the deformation of the Keewatin and Temiskaming was post-Temiskaming.

The sediments at the Dome have been greatly altered to schists. Similar rocks around Three Nations lake have been less altered, and, except for a high dip, greatly resemble the Cobalt series.

The succession of Temiskaming strata is well shown at the property of the Three Nations Mining Company on lot 5 in the fifth concession of Whitney. Along the line between the fifth and sixth concessions very much altered Keewatin rocks, now largely serpentine and rusty carbonate, are exposed. The contact with the Temiskaming conglomerate practically follows this line. At the base of the conglomerate are numerous fragments of rusty weathering Keewatin rocks; while farther to the south there are numerous pebbles of acid rocks, including the quartz-porphyry, felsite, etc. The conglomerate is overlain by a narrow band of fine-grained black slate, which splits in very thin layers. Overlying the slate is a greywacké which becomes coarser toward the south. About half a mile south of the concession line the rock is quite coarse-grained, and may be called an arkose-like quartzite. Throughout the Temiskaming series there is considerable carbonate, and many samples effervesce briskly with acid.



Interbanded quartzite and slate of the Temiskaming series, showing secondary cleavage. North Dome mine, Oct. 1911.

It should be noted that no granite pebbles were found in the conglomerate. It is believed that the series was laid down when the surface rocks were largely volcanics, and that the intrusion of at least part of the granite came after the deposition of the Temiskaming, but prior to the Cobalt series.

At the North Dome there is a strikingly banded rock which was originally formed by a succession of fine clay and rather coarse sand layers. A secondary cleavage is developed at a low angle with the upturned edges of the strata.

On the Foley-O'Brian the sediments in addition to being highly tilted show a wavy structure along the strike.

At the Dome property, in contact with large quartz masses, is a conglomerate which is likely basal. On the weathered surface the included fragments of porphyry, greenstone, schist, etc., are conspicuous, but in freshly broken pieces the conglomeratic character is easily overlooked, since the rock breaks in prismatic blocks resembling schist. The included pebbles are frequently drawn out in the direction of the schistosity. A thin section of greywacké from a mile west of the north end of Porcupine lake shows angular fragments of quartz and feldspar, together with sericite and other secondary minerals.

Greywacké, with strike east and west and dip 85° north, occurs on the northeast shore of Night Hawk lake. In the greywacké are thin bands of conglomerate containing pebbles of dark green Keewatin rock, numerous quartz pebbles and some felsite. Some of the pebbles are six inches in diameter. A sample of the greywacké is seen under the microscope to consist of angular fragments of quartz and feldspar, with finer particles of the same material and chlorite, sericite and limonite.

Altered sedimentary rocks outcrop at Wawaitin falls on the Mattagami river. These rocks have been greatly metamorphosed, but conglomerate, slate and quartzite can be recognized. Some rusty bands of carbonate occur with the sediments. Similar rocks occur in Bristol township and at several points along the Mattagami river below Wawaitin falls. These rocks were formerly classed with the Keewatin, but from a similarity to the sedimentary rocks in Tisdale they are now grouped with the Temiskaming.

On Red Sucker creek near Wawaitin falls at the third rock exposure from the Mattagami river there is a fresh looking greywacké which greatly resembles Huronian greywacké at Cobalt. The rock consists largely of quartz and feldspar with some bits of rock like quartz-porphyry in a cement of finer material consisting of quartz, feldspar, sericite, etc.

Mr. J. G. McMillan has recognized a group of altered sediments dipping at high angles in Midlothian township, about 40 miles south of Porcupine, which he has classified as Temiskaming.[17]

Cobalt Series

The younger series of sediments has been observed only in small volume on the south boundary of Langmuir. Here there is a typical undisturbed boulder conglomerate, very similar to the Cobalt conglomerate. It contains numerous pebbles and boulders of red hornblende and biotite granite, and rests unconformably on a Keewatin greenstone. Fragments of Keewatin occur at the base of the conglomerate.

Later Intrusives

In all parts of the area are numerous basic dikes which are generally less than 100 feet in width. Some of these are of olivine diabase. One such dike occurs on the south boundary of Whitney township in lot 12. The rock shows fairly fresh plagioclase set in ophitic fashion in augite. The latter mineral has a decided purplish colour, due to the presence of titanium. Grains of olivine showing high relief, and a few scattered flakes of biotite and magnetite, also occur.

Basic dikes intruding Keewatin greenstone occur on several islands in Night Hawk lake. A thin section of one of these shows a diabasic texture. Rods of labradorite are set in augite, which is beginning to alter to green hornblende. Quartz is present in clear grains and as an intergrowth with albite.

A similar diabose intrudes the Huronian greywacké on the northeast bay of the lake. Many of these narrow basic dikes in thin section greatly resemble the sill diabase of the Cobalt silver area.

A dike of diabase 10 feet wide cuts a ferruginous carbonate rock on the most southerly Dome claim in Tisdale. At this point the carbonate is not intersected by quartz veinlets, and it was not possible to determine the relationship of the dike to the quartz veins.

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[17] Report of the Geology of the Area along the T. & N. O. Railway Trial line between Gowganda and Porcupine, 1912.

A dike of very fresh diabase was encountered in the diamond drilling at the Dome Extension. It is made up of laths of labradorite and augite as the chief constituents. In subordinate amounts are interstitial quartz, magnetite and pyrite.

These basic dikes are considered to be of much later age than the quartz veins of Porcupine. In Bristol township, at the McAuley-Brydge claim, a N. and S. 37-foot dike of later diabase cuts across the gold-bearing quartz-schist band which strikes E. and W.

There is a very prominent hill about 250 feet high to the southwest of Kamiskotia lake which is composed of a basic rock, some of which is very coarse grained, like gabbro. This mass is likely a great dike, with northwest-southeast strike, which crosses Niven's line two miles to the southeast. Thin sections of two samples of the rock have the structure of gabbro, rather than diabase. Quartz, if present at all, is only in minor quantity, and the rock does not closely resemble the Cobalt sill diabase.

Relation of Quartz Veins to Granite

Beck, in his work entitled "The Nature of Ore Deposits," states that "quartz veins more often occur in regions where the older schistose rocks are broken through by granitic, dioritic and diabasic rocks, and are genetically connected with such intrusions." It has been suggested in the notes accompanying the editions of the Porcupine map that the quartz veins of Porcupine are probably the result of a granitic intrusion, the immense quantity of quartz present in the veins having been supplied by the acid magma as a differentiation product. The primary quartz of the veins shows evidence of having been deposited under great pressure, with numerous cavities of gas and liquid inclusions. It has also a marked crystallized structure, with incipient crystal faces showing etched surfaces. The quartz has filled the fissures rapidly, as there is generally an absence of well-defined walls, except where there has been secondary movements. Quartz and rock are often cemented, forming a contact like that of an intrusive.

Mr. C. W. Knight noted the occurrence of feldspar in a quartz vein on the Miller-Middleton, one of the Timmins locations, and suggested the relationship of the deposit to granite or pegmatite dikes. The feldspar which is an acid plagioclase has also been noted in other veins, including the No. 1 vein of the Hollinger, the Rea vein, and in many of the narrow veins in the vicinity of Three Nations lake. The feldspar is most abundant near the margins of the veins. The extinction angle of the feldspar in the veins on the Three Nations Lake Mining Company's claim shows it to be very near albite. A chemical analysis of this feldspar gave: Soda, 10.37 per cent.; potash, 0.90 per cent.

The relationship of quartz veins to pegmatite and aplite has been mentioned by several writers. In the Black Hills of South Dakota, C. R. Van Hise noted the gradual transition from intrusive granites through pegmatite dikes and with decreasing quantity of feldspar to quartz veins remote from the granite.[18]

J. E. Spurr, in "The Geology of the Yukon Gold District, Alaska," referring to a set of younger quartz veins on Forty Mile creek, says: "They often contain a little feldspar and sometimes, by increase in amount of this mineral, pass into a variety of fine pegmatite. This in turn seems to be transitional into a coarse aplite which is very abundant."[19]

De Launay in his work, "The World's Gold," refers to the relation of the gold to the granitic rocks. "At Berezovsk in the Urals in certain veins of microgranite, which themselves cut talcose schists, there are numerous very thin veins of auriferous quartz, containing various sulphides of copper, lead and bismuth, with gold, chromium, and tourmaline, and the granitic mass from which the micrograntes are derived appears itself to be auriferous."

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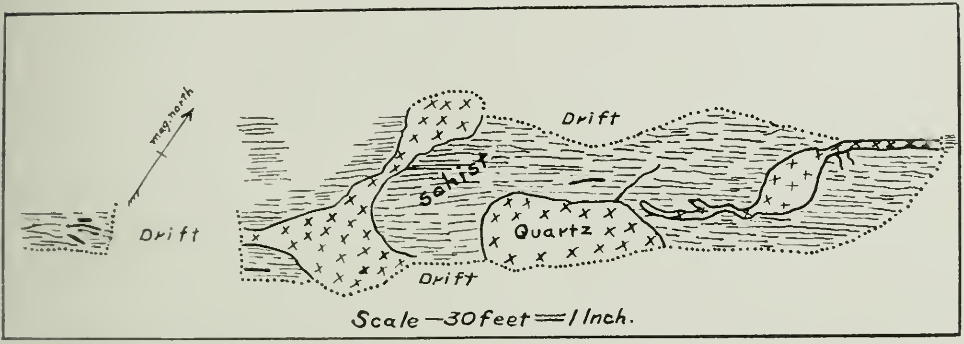
[18] U. S. Geological Survey, 16th Annual Report, Principles of North American Pre-Cambrian Geology.
[19] U. S. Geological Survey, 1896.

Other Vein Minerals

The mineral scheelite, calcium tungstate, occurs in some of the veins around Pearl lake as one of the earliest constituents. It has been found in the Jupiter, Plenaurum, McIntyre and Hollinger, but only in very minor quantity. It is interesting to note that scheelite generally occurs with minerals like topaz, cassiterite, tourmaline, and arsenopyrite in pegmatitic veins, which are considered to have a genetic relationship with granites. The presence of scheelite in the Porcupine veins may point to the pegmatitic character of the veins in this area.



Sketch showing lenticular character of quartz bodies at Hughes' property, North Whitney.

Quartz masses in contact with schistose conglomerate. Dome mine, Nov. 1910.

Tourmaline occurs quite frequently, not only as a later mineral in the veins but with the original quartz, as at the Dome Extension, West Dome and other properties.

Arsenical pyrites is abundant in the quartz veinlets on the McAuley-Brydges claim in Bristol township.

In support of the theory of the relation of the quartz veins of Porcupine to granite intrusions, may be mentioned the following:

1. The irregular occurrence of the quartz in many of the deposits, in lenticular masses, resembling pegmatite dikes.

2. The occurrence of feldspar, scheelite, and tourmaline in the quartz in several deposits.

3. The great pressure at which the quartz has been deposited, indicated by the presence of liquid inclusions and gas bubbles. These are frequently seen in quartz in granites.

4. The frozen contacts of quartz and enclosing country rock. The free walls seen at some properties indicate a secondary movement in the quartz, since these walls are slickensided. Where free walls exist they may be either the hanging or foot wall, while the other wall is indistinct—grading into the country rock.

5. The occurrence of narrow felsitic dikes, frequently cut by minute veinlets of quartz, which represent the final solidification of the felsitic magma, and which frequently carry gold values as on Night Hawk lake.

Character of the Gold=Bearing Deposits

The occurrence of gold at Porcupine is associated with the quartz solutions which circulated through the fissures in the Keewatin and Temiskaming series. The irregular fissuring has produced a great variety of quartz structures, varying from the tabular, though often irregular or lenticular, vein which may be traced several hundred feet, to mere veinlets, often only a fraction of an inch in width and a few feet in length, which ramify through a rock that has been subjected to small irregular fissuring. This latter variety is well illustrated in the fissuring of ankerite bands, so characteristic of some of the gold deposits of Porcupine. Irregular and lenticular bodies of quartz often occur which may have a width of ten or twenty feet, but which die away in a distance of fifty feet. Again, there are dome-like mases of quartz which are elliptical or oval in surface outline. In some parts at least these masses can be seen in contact with underlying rocks at a low angle, which would suggest that they are broad lenticular masses which have filled lateral fissures in the country rock. The most conspicuous dome masses are those of the Dome property, where the two largest are about 125 feet by 100 feet. A fissure may be vertical and regular at some points. At others it may incline at a lower angle to the horizontal or take on a more or less lenticular form.

The term "vein" as used in this report is not confined to the filling of a single fissure with well-defined walls, for this type of vein is rather the exception in the Porcupine area. The fissuring has been so irregular that a "vein" in one part may consist largely of quartz, and in another part of numerous veinlets of quartz and intervening schist, greatly resembling a stockwerk; again, the main part of a vein may be almost vertical in attitude, but many veinlets, as branches from the main vein, may extend laterally into the country rock. It is often found that the values are obtained in parts of the vertical vein which have been subjected to a later movement and enrichment, whereas the lateral veins have little or no value. This is illustrated in the No. 1 vein at the Rea mine.

The relationship of the strike of the veins to that of the enclosing rock is often difficult to determine, since generally along the veins there has been shearing of the country rock which may conform to the general direction of the strike of the veins. However, by determining numerous strikes in the schist away from the veins, it is seen that the majority of them are inclined to the strike of the enclosing rocks. In dip the veins vary from vertical to nearly horizontal. In No. 1 shaft of the Hollinger the vein is practically vertical, while a series of narrow quartz veins, 6 to 18 inches wide on the Lindburg claim, have a dip at the surface of only 20°. The prevailing dip of the schist in the Porcupine area is to the north at a high angle, and frequently the veins dip distinctly to the south across the cleavage of the schist. While it is apparent that most of the deformation of the country antedates the vein formation, nevertheless there is a decided tendency in many cases for the fissuring to be influenced by the direction of schistosity, which is also a direction of weakness; hence we find veins having a more or less lenticular structure, the strike of which closely corresponds to that of the country rock.

Lenticular veins occur chiefly where the country rocks have been intensely sheared or rendered schistose, as around Pearl lake. Usually when there has been less disturbance the veins are more likely to have a marked difference in strike from the enclosing rock—as around Three Nations lake and the porphyry area south of Simpson lake. It may be stated that the larger and usually lenticular veins of the area occur where the rocks are extremely schistose, while the narrower, better defined veins occur as stringers from these main lenticular veins, or in less disturbed areas.

Narrow quartz veins (auriferous) cutting conglomerate at Three Nations Mining Co., Sept. 1911.

Distribution of Veins

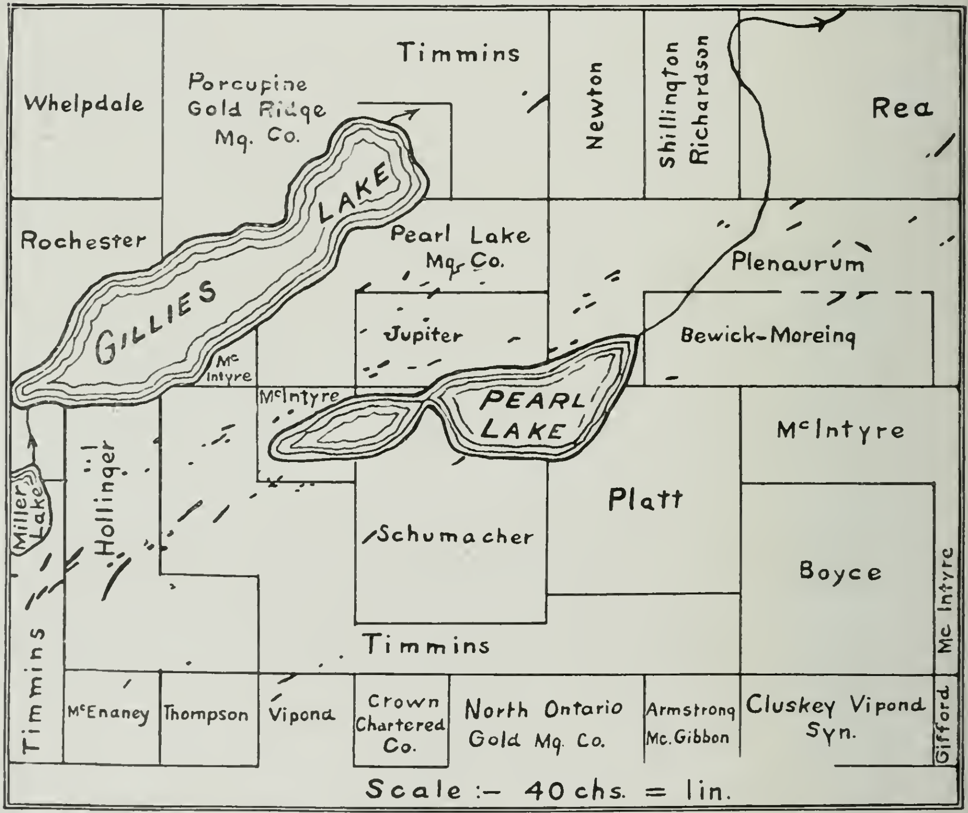
While gold-bearing veins occur over a wide area and are often isolated, it is seen, from a number of those already discovered, that they occur in groups along certain lines. For instance, in Tisdale township there are at least three distinct areas where the fissuring has been most pronounced. One such area extends from the southeast end of Miller lake, on lot 11, in the second concession, in a northeasterly direction for three miles, and includes such veins as the McEnaney, Miller-Middleton, Hollinger, Dixon, McIntyre, Jupiter, Rea, and in addition others with visible gold. The average strike of the veins here is northeast and southwest. An exception is a vein on the McEnaney, which strikes northwest and southeast.

Another series, including the Smith, Davidson, Crown Chartered and Dobie, occurs in the northeast part of the township. To these should be added the Scottish-Ontario, Mullholland, Hughes and Gold Reef, which are in the northwest part of Whitney township. The general direction of these veins is east and west.

Again, in the southeast part of the township is a group including the Dome Lake, West Dome, Dome, and Dome Extension, with a general strike north of east.

Similar groupings could be mentioned in other parts of the area in which gold-bearing veins have been found.

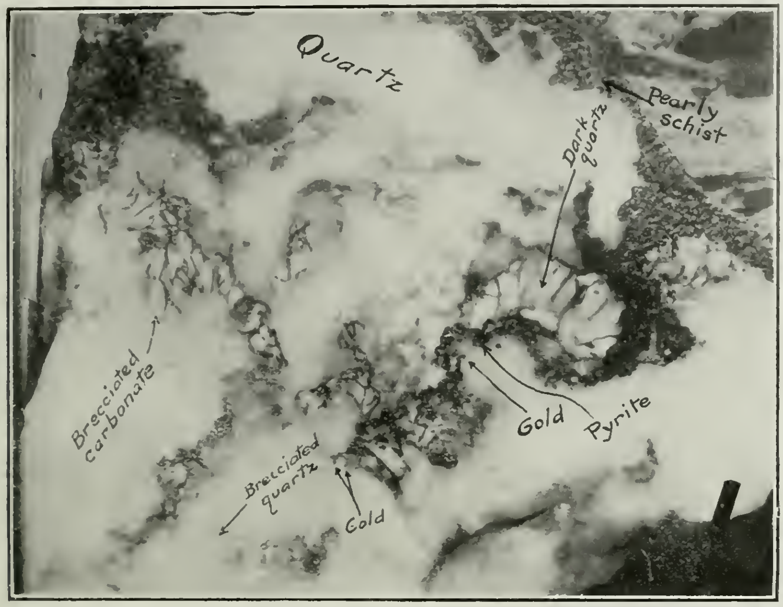
Well defined, disturbed zones occur in the fifth concession of Tisdale. In this locality the main rock is a light greenish, fine-grained, rather massive greenstone. This greenish rock is itself not much fissured, but here and there through it are bands of rusty-weathering carbonate, which is generally schistose, striking east and west. I think that much of the carbonate associated with this greenstone is of secondary origin. It is possible that the shattering and fissuring of the greenstone in an east and west direction may have caused a deposition of migrating carbonate solutions, partly filling fissures and partly replacing the greenstone. These carbonate bands were later fissured, and gold-bearing quartz solutions deposited in them. The fissuring of the carbonate is generally irregular, and hence we find veins with steep or low dip striking with the schist and across it. This irregular series of veins is seen at the Crown Chartered and Dobie properties. Where the veins are small, it becomes necessary to mine both the carbonate and the intersecting quartz veins. Gold often occurs in the carbonate near the contact with the quartz veins, as well as in the quartz.



Plan showing the general northeast and southwest distribution of veins in the Pearl lake area.

Occurrence of the Gold

A field examination shows that there is an irregular distribution of the gold in the quartz veins. Very often it occurs along dark streaks in the quartz, along the contacts of quartz and schist, or around patches of dark coloured mineral in the quartz. At the surface, rich portions of veins are often indicated by rusty streaks or patches, while at depth the rusty character gives place to dark gray, black or greenish colours.



Brecciated structure of quartz from McIntyre main vein (natural size).

Streaked ore from the Jupiter mine. The dark lines are tourmaline, while the intervening quartz is greatly crushed and shows visible gold.

Under the microscope the gold is generally found in areas which have been greatly crushed or in the quartz or schist bordering on these areas.

The prominent minerals which occur in the crushed areas are pyrite, calcite, dolomite, sericite, chlorite, tourmaline and quartz. It is thought that most of the gold has been deposited along with pyrite from the impure solutions which circulated in the minute fissures and crushed areas of the primary quartz of the veins. The quartz of No. 1 vein of the Hollinger mine shows numerous dark streaks in parts of it and often across the width of the vein. These are generally short and irregular in distribution. Iron pyrites and often galena occur with the gold. Microscopically, the quartz occurs in fairly large grains, contains liquid and gas inclusions, and has been subjected to secondary pressure and granulation along the margins of the grains. The iron pyrites often occurs in well shaped crystals which have been formed subsequent to the crushing.

These fine dark streaks may have resulted from a solidification and shrinkage of the quartz forming filmy cracks, which may have become slip or crushing planes along which the richer gold-bearing solutions were deposited at a later period.

These minute dark streaks in the quartz are frequently slickensided, and this character may often be seen in hand specimens, as from Rea or Vipond mines.

It should be noted that where cracks or fracture planes have been produced in a quartz vein and subsequently filled by minerals from solution, secondary quartz can be distinguished with difficulty, if at all, from the original quartz. Hence it is not always possible to say whether visible gold in such a vein occurs in the original or in secondary quartz.

Often a vein may show a width of ten feet but the fractured portion may be only a few feet, or even inches, wide along either wall. In this portion there may be many streaks of dark mineral which are often parallel, giving a banded character to the ore, as in many of the veins in the north part of Whitney and Tisdale, namely, at the Mullholland, Scottish Ontario, Davidson and adjoining properties. A similar banded structure is seen at the Rea mine. At these properties tourmaline is the principal mineral of the streaks. The gold may occur along these lines or in the intervening quartz, which is often much crushed and filled with later minerals.

Several sections were examined, which showed grains of gold apparently enclosed in the primary quartz, but the occurrence is much less prominent than where gold occurs in the crushed areas.

It is important to note that practically all the veins which are gold-bearing contain considerable carbonate of varied composition. Wherever the enclosing rocks are schistose they always carry carbonate and frequently effervesce with cold hydrochloric acid. Much of the carbonate of the veins has been absorbed from the wall rock, while portions have been formed from ascending solutions which circulated in the veins. Pyrite and grains of gold frequently occur in the carbonate.

Carbonate in the form of ankerite constitutes the main portion of veins at the West Dome, Apex, and in parts of Deloro township. This carbonate is distinctly earlier than the quartz veinlets which intersect the ankerite veins. Both the ankerite and quartz have been fractured and veinlets of later carbonate deposited in them.

Thin Sections of Vein Quartz

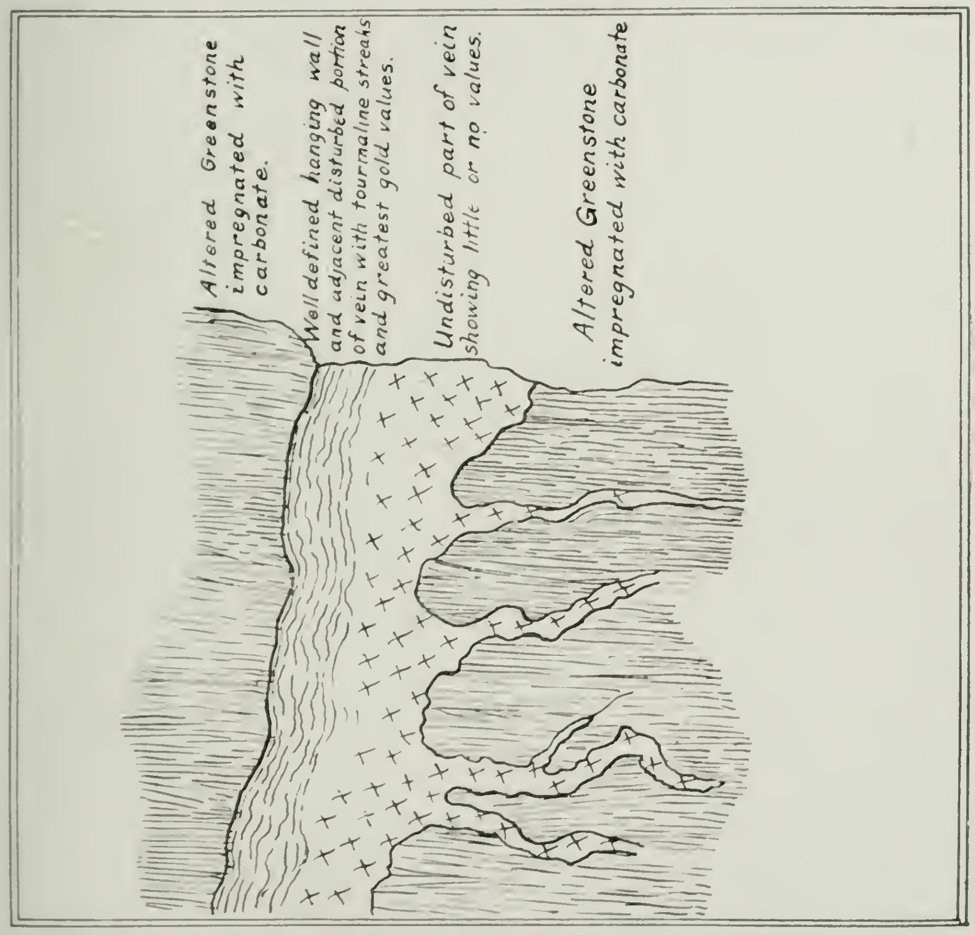
In drawing No. 1 of a section of Hollinger ore the fracturing of the original quartz is evident, while veinlets of calcite penetrate the quartz. Grains of a dark mineral, galena (?), are arranged in a linear manner in the calcite and quartz, and a few grains of gold occur in the calcite or along the contact of quartz grains and calcite.

In drawing No. 2 of a section of Dome ore there is very little dark mineral. The crushed zones are quite clearly shown. Some of the larger grains of quartz have a dusted appearance, while some of the finer grains are quite clear and may be a later quartz. In the crushed areas are grains and strings of gold, and also crystals of iron pyrites, on some of which gold is deposited.

In drawings Nos. 3 and 4 of sections of quartz from the Hunter claim, Porcupine lake, the quartz is almost all very fine-grained, which condition may have been produced by crushing of larger grains. In No. 3 remnants of plagioclase feldspar remain, and a grain of pyrite shows several gold grains deposited on it.

Drawings Nos. 5 and 6 also show crushed areas. In No. 6 a grain of gold occurs in a large grain of quartz as though a constituent of the primary quartz.

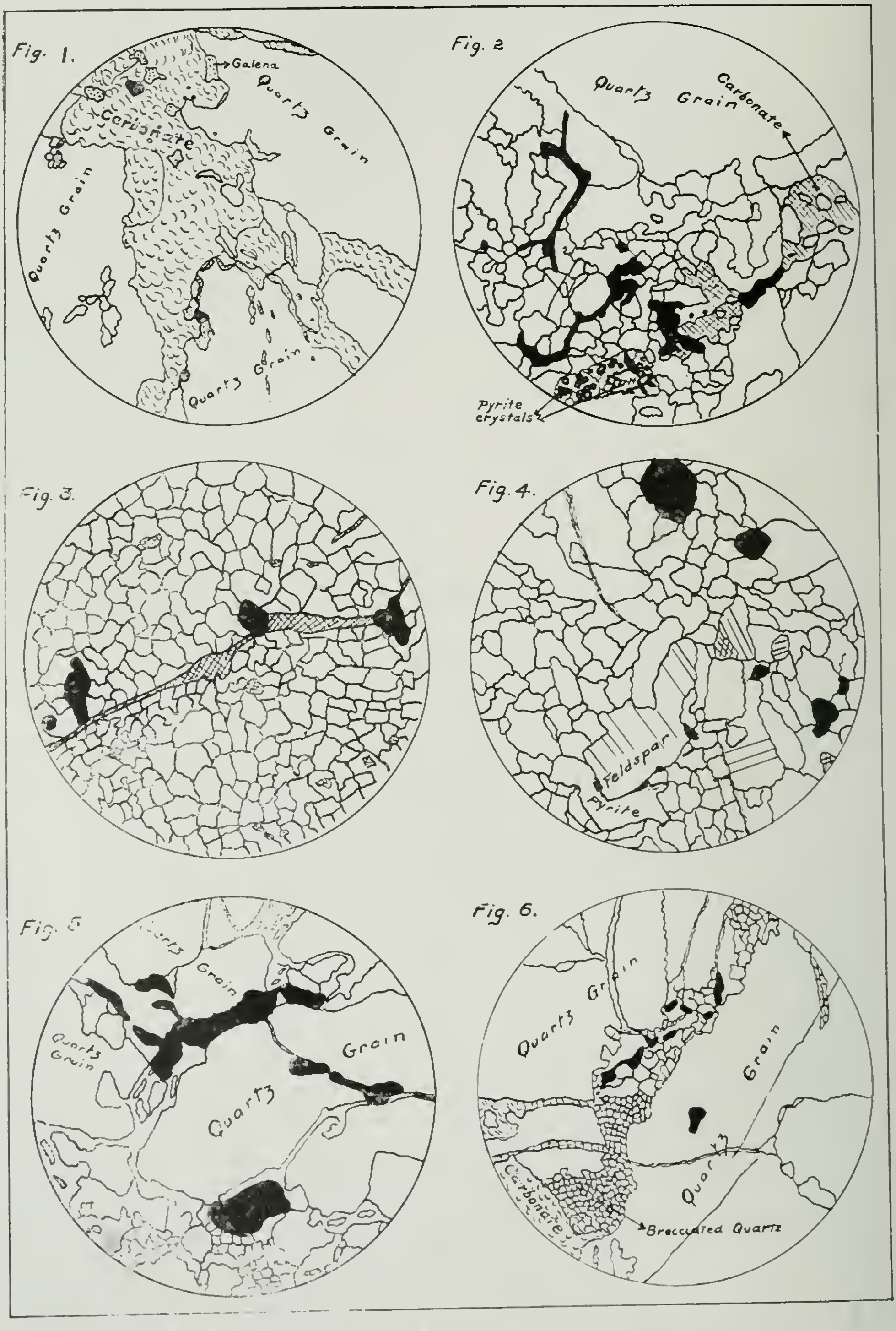
The following sulphides have been recognized in veins at Porcupine: iron pyrites, copper pyrites, pyrrhotite, arsenical pyrites, galena and zincblende. Of these the most abundant is iron pyrites, which occurs in some quantity in all the gold-bearing veins.


Altered Greenstone impregnated with carbonate.
Well defined hanging wall and adjacent disturbed portion of vein with tourmaline streaks and greatest gold values.
Undisturbed part of vein showing little or no values.
Altered Greenstone impregnated with carbonate

Ideal section of vein showing veinlets extending into wall rock. This structure is frequent in the north part of Tisdale. The above sketch somewhat resembles the main vein at the Rea mine as shown near the surface.

Copper pyrites, galena and zincblende, although also widely distributed, occur in minor quantity. Pyrrhotite is the chief sulphide in the veins which are being developed in No. 4 shaft of the Dome Extension. Arsenical pyrite occurs in quantity in the quartz veins at the McAuley-Brydges property in Bristol township.

Only one telluride has been recognized, occurring in the quartz-carbonate deposit at the Powell claim, M.E. 20, in Deloro township. A chemical test of the mineral gave the following percentages: silver, 61.88 per cent.; gold, 0.10 per cent, with strong reactions for tellurium, corresponding to the mineral hessite. Native gold occurs as a later constituent in minute seams in the hessite. Robt. Harvie reported the telluride



Drawings of thin sections of ore, from Porcupine quartz veins. No. 1, Hollinger. No. 2, Dome. Nos. 3 and 4, Porcupine Lake. No. 5, Rea. No. 6, Vipond. Black spots are native gold magnified 30 diameters.

"petzite" in quartz-ankerite deposits at Opazatica lake in the province of Quebec.[20] The presence of telluride in a quartz ore, containing considerable pyrites, from the Mikado mine, Lake-of-the-Woods, has lately been recognized in the laboratory of the Provincial Assay Office.

The rare mineral scheelite has been found in small quantities in several properties around Pearl lake. This is the second noted occurrence of this mineral in Ontario, it having been reported on the dump at the Victoria mines, near Sudbury.[21]

Since the whole surface of the area has been deeply eroded during recent glacial periods, there is now little evidence of secondary enrichment. The enrichment is very superficial, extending only from a few inches to a few feet in depth. The outcrops of the veins and wall rocks are usually discolored or decomposed, due to the oxidation of the iron pyrites and the ferrous carbonate in the ankerite or other iron-bearing carbonates. Cubes of iron pyrites are occasionally obtained at the surface, while copper pyrites and arsenopyrite also occur near the surface. Where the veins have been oxidized to any depth, there are generally some very recent water courses in evidence. Developments so far have shown that, after this very superficial zone has been penetrated, the character of the vein material has remained the same as far as mining operations have continued, namely about 300 feet.

Working Properties

Following is a description of some of the working properties visited in March, 1912.

Hollinger Mine

The main workings of the Hollinger Gold Mines are situated about half a mile southwest of Pearl lake. This property has received the greatest attention of any in the Pearl lake section, having been under development since the winter of 1909-10, following the discovery of gold on the Hollinger claims.

At the end of March last about 5,000 feet of development, consisting of shafts, winzes, raises, cross-cuts and drifts, had been accomplished. Most of this work is on the 100 and 200-foot levels, on veins Nos. 1, 2, 3, 4 and 8. A permanent main shaft, consisting of three hoisting compartments and one ladder compartment and pump-way, has been sunk to the west of No. 1 shaft to a depth of 200 feet. This will be continued to the 400-foot level and connected with the winze which is at present being sunk from the 200-foot to the 400-foot level on No. 1 vein.

An examination of the accompanying plan will show that the principal veins strike almost N.E. and S.W., and are approximately parallel. Development has shown that the ore bodies are nearly vertical, and that they cut the schist at a very low angle to the north. The main Hollinger vein, No. 1, has been traced on the surface for over 900 feet, and on the 100-foot level for 1,000 feet, with an average milling width of 8 feet. This length is the greatest over which a vein has been traced continuously in this section. The vein is not uniform in physical character, varying in width from 20 feet to 2 feet. Parts of the vein are represented by masses of quartz, and other parts by numerous narrow stringers of quartz with interbanded schist. Iron pyrites is the prominent sulphide mineral occurring in the wall contiguous to veins, and also in fracture planes of the quartz. Galena and zincblende occur in minor quantities. Scheelite occurs in small isolated nodular masses in parts of the veins.

The other veins being developed along with the No. 1 vein are not so regular in character or so high in value as the main vein. They occur rather as very lenticular masses of quartz or as highly schistose bands of country rock, very much impregnated with secondary quartz, calcite and iron pyrites.

Where the main cross-cut on the 100-foot level cuts No. 4 vein there is a width of 22 feet, consisting largely of quartz, while in the drift to the southwest the quartz mass tapers very abruptly. No. 2 vein consists principally of schistose rock mineralized with iron pyrites in cube form, while quartz and calcite occur abundantly in the schist. Drifting on this vein has also shown interfoliated quartz and schist.

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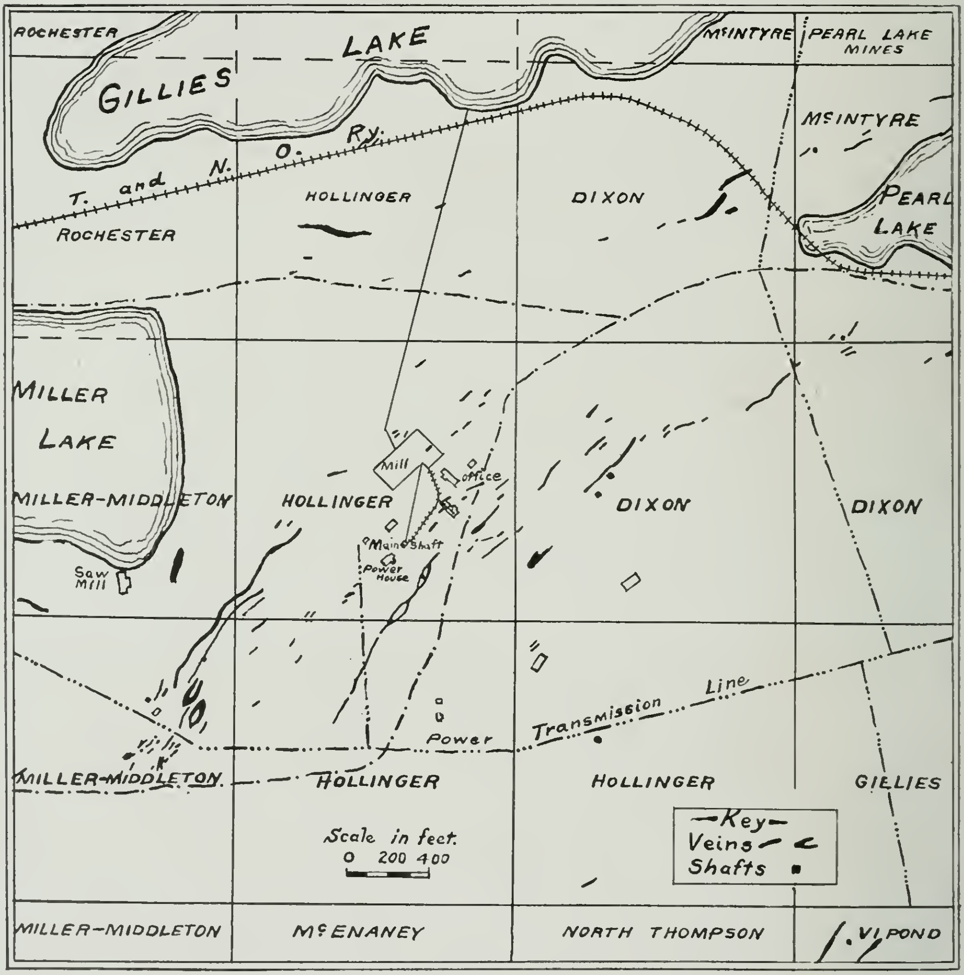
[20] Notes on a Discovery of a Telluride Gold Ore at Opasatica &c., The Journal of the Canadian Mining Institute, Vol. XIV., p. 161.

[21] Report on the Tungsten Ores of Canada. T. L. Walker, Department of Mines, Canada, 1909.

The following notes relative to the occurrence of the gold at this property have been taken from Mr. P. A. Robbins' First Annual Report.

So far no heavy faulting has been encountered, but there are many sinuous twists and turns in the veins, the veins being practically vertical, as far as developed, showing some tendency to dip to the southeast. The schist is heavily mineralized with iron pyrite and, generally speaking, pyrite is disseminated throughout the quartz masses, being contained in the cleavages, particularly near the walls.



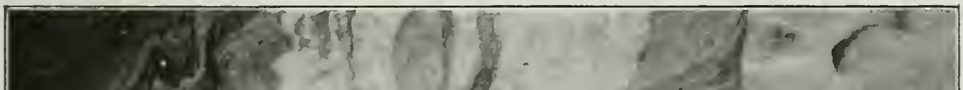
Surface plan of Hollinger and adjacent properties.

The gold has evidently been deposited contemporaneously with, or a little later than, the pyrite, as occasional instances have been noted where the pyrite is encased in gold.

Generally the occurrence of galena portends rich gold values, and to a lesser degree the occurrence of sphalerite is an indication of gold values.

Large blocky crystals of pyrite are usually attended by low values in gold, while the finely crystalline pyrite occurs with relatively higher gold values.

Mass of quartz at Hollinger mine. S. E. of No. 1 shaft. Oct. 1911.



N. W. wall of No. 1 (Hollinger vein) on 100-foot level, just N. E. of No. 8 shaft.
Width of exposure, 6 feet.

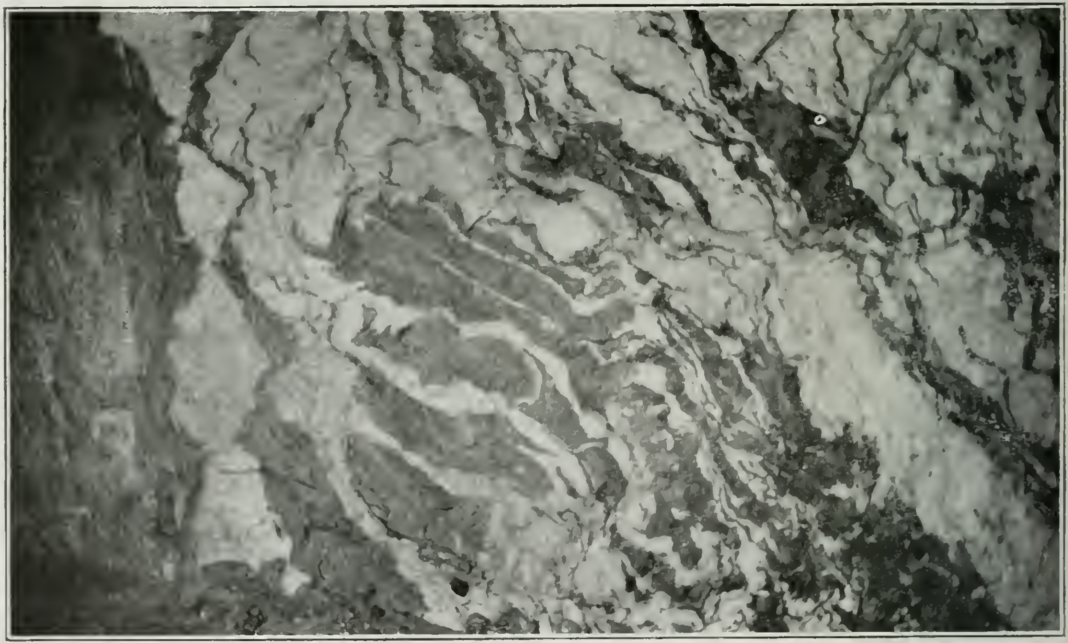
The schist walls of the main vein do not usually carry payable values, except where contiguous to rich sections of the vein, and in such cases the schist seems to be more or less silicified, pointing to the silica-bearing solutions as having also provided the gold. Generally, the southeast wall is the richer.

In other cases, notably vein No. 2, the schist, where it is interfoliated with small quartz stringers, carries relatively high gold values.

There are evidences of the metasomatic replacement of schist by quartz, the replacement in many instances being incomplete.

In the quartz masses the occurrence of gold is extremely spotty, and check samples taken from the same points on the vein will seldom agree within reasonable limits.

Our sampling has shown that the occurrence of visible gold does not necessarily mean payable values, and, to the contrary, payable values are commonly found where no visible gold has been observed. The quartz where streaked by fine lines of pyrite in the cleavages is generally more consistent in the matter of gold values than the clear masses carrying occasional spectacular showings.



Contact of quartz and schist on the N. W. wall of No. 4 vein Hollinger mine where vein was intersected in the first cross-cut from No. 1 vein on the 100-foot level. Width of exposure, 6 feet.

A mill which will have a crushing capacity of 300 tons per day and a cyanide plant are at present being installed on the property. Experimental tests showed the necessity for fine grinding, and also the advisability of extracting the concentrates for separate treatment.

The process as decided upon is:

Coarse grinding,
Stamping in cyanide solution,
Tube milling,
Concentration followed by amalgamation of concentrates,
Cyanide treatment of both gangue and concentrate residues.

The apparatus being installed consists of:

One gyratory crusher,
One jaw crusher,

Sampling plant,
Forty 1,500-pound stamps,
Four Dorr classifiers,
Four five-foot diameter by twenty feet long tube mills,
Spitzkasten.
Forty Deister slimes tables,
Four Dorr pulp thickeners,
Four Trent agitators,
Two Moore filters,
Two Merrill clarifying presses,
Two Merrill precipitation presses, and the usual pumps, amalgamating pans, settlers, etc.

The mill will be electrically driven throughout.

Jupiter

This property is situated on the north side of Pearl lake. Very schistose porphyry and other acid rocks occur as a belt about 300 feet in width adjoining the lake. North of this belt is a ridge of less altered greenstone. The veins which are at present being developed are in these schistose acid rocks, which have been greatly impregnated with carbonate. When the property was visited in March, about 2,300 feet of work, consisting of shafts, drifts and cross-cuts, had been done. An inclined shaft (No. 1) was down 100 feet, while two vertical shafts, No. 1B and No. 2, were down 200 and 300 feet respectively. Shafts No. 1 and No. 1B are connected on the 100-foot level, and veins have been drifted on at the 50, 100 and 200-foot levels. No. 2 shaft, which is near the Jupiter-Plenaurum line, has levels at 100, 200 and 300 feet. At the 100-foot level a cross-cut shows 19 feet of interbanded quartz and schist. As in other properties, the veins vary considerably in width and character. Sometimes they may be largely quartz, and again an intimate mixture of schist and quartz. Values do not usually extend into the wall rock to any distance, but where schist and quartz occur interbanded good values are often obtained in the schist. The schists are nearly vertical, while the veins dip to the north at about 75°, but may approximate the strike of the schists.

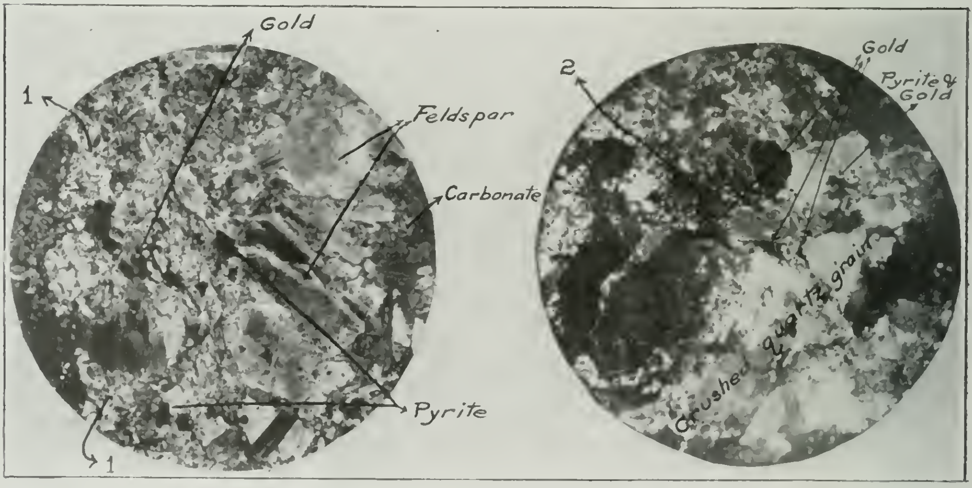
The ore occurs as shoots in the veins, and it has been noted that the values in the veins will varying according to the enclosing rock. When the wall rocks have been greatly altered by carbonate solutions and impregnated with iron pyrites, the veins are likely to be of greater value than when they occur in less altered rocks. The mineral scheelite was first noted in the quartz at this property.

McEnaney

The McEnaney is situated half a mile south of the Hollinger. A shaft was sunk in the quartz-porphyry on a quartz vein striking N.E. and S.W., which at 50 feet dipped from the shaft. Drifting and cross-cutting on the 100-foot level failed to pick up this vein. However, diamond drilling from the 100-foot level indicated a vein to the south of the shaft, having an entirely different strike from that at the surface, namely, N.W. and S.E. Two cross-cuts from the old workings on the 100-foot level intersected this vein and, by drifting, it has been traced 110 feet. The vein increases in width toward the S.E., where a face showed a width of 7 feet. This vein was also encountered on the 200-foot level and had been drifted on for 75 feet. It dips to the N.E., and at the 200-foot level is to the north of the shaft. Sinking was being continued to the 300-foot level. The quartz in the vein has been disturbed, and in parts of it are streaks of iron pyrites along which gold occurs. There is also considerable carbonate of later formation than the quartz. It frequently carries fragments of quartz and also shows visible gold.

The hanging wall of the vein at the 200-foot level is an altered quartz-feldspar-porphyry now much impregnated with carbonate and sericite; calcite has almost wholly replaced the feldspar in some phenocrysts. The foot wall is much more altered and finer grained. It may have been a porphyry, since some remnants of acid plagioclase remain, but the rock now consists largely of fine grains of calcite, sericite, quartz and chlorite. A sample of ore showing much carbonate was examined under the microscope. It contains numerous fragments of plagioclase feldspar, much broken up and invaded by calcite, tourmaline and sericite; quartz grains also occur through the carbonate. Pyrite is scattered throughout the carbonate, and most of the gold is clustered around the pyrite crystals, while it is also visible in some of the crystals. It is very likely that some of the porphyry wall rock has been taken up by the vein solutions, or that the enrichment has penetrated the porphyry.

Quartz vein on 100-foot level, McEnaney mine. The dark spots are drill holes.



Microphotograph, McEnaney. Microphotograph, Vipond.
1. Fine grained carbonate, tourmaline, quartz, feldspar, and sericite.
2. Brecciated quartz with later carbonate.

Vipond

This property, which is situated about three-quarters of a mile south of Pearl lake, was one of the earliest in the area on which gold was discovered. The rock enclosing the veins is an altered greenstone which often shows amygdules. It is somewhat schistose, but is more massive than the altered porphyries near Pearl lake. Characteristic torsion cracks, so often seen in Keewatin greenstone, occur frequently.

When visited in March, considerable development had been accomplished. Two veins, Nos. 2 and 3, which have a general N.E.-S.W. strike, had been partially developed on the 100 and 200-foot levels. Drifting on the 100-foot level has exposed an ore body of 430 feet on No. 1 vein and on the 200-foot level of 350 feet. Where No. 3 vein was cross-cut on the 100-foot level it showed a width of 30 feet of banded quartz and schist, of which a width of 20 feet gave milling values. About 2,000 feet of drifting had been accomplished. The veins dip at a high angle to the S.E. On the 100-foot level there is an ankerite vein along the foot wall at No. 1 vein, which was formed earlier than the quartz vein. Dark streaks more or less parallel with the vein, were noted in the quartz of No. 2 vein. In the sampling of this vein an arbitrary width of 3½ feet was adopted. The only prominent sulphide occurring in the vein is iron pyrites, while the ore is largely free-milling.

Vipond mine, March, 1912. Preparing site for mill.

The following description of the treatment of the ore has been given by Mr. C. H. Poirier, superintendent of the property.

The "mine run" passes over a grizzley, spaced to 1½ inches; the oversize goes through a jaw crusher, joins the grizzley product and goes through rolls, set to ¾-inch; this product is elevated to 200-ton bin; from there it passes through James feeders to two 4½-foot Hardinge ball mills, with chrome steel lining and 3-inch chrome steel balls; these mills crush to 20-mesh. The head sample of the mill is taken at the discharge of these mills; the product then passes to a Colbath classifier, the slime (120 mesh and over) passes directly to the plates, the sands are discharged automatically to the feed boxes of two 6½ x 6-foot Hardinge pebble mills, with silex linings and flint pebbles; these mills discharge to another Colbath classifier, the –120 mesh is returned to pebble mills, and the +120 mesh goes over plates. From the plates the product runs to a storage dam, for further treatment, or to waste.

It may be decided to amalgamate between the ball and pebble mills later on if it seems advisable.

McIntyre

The McIntyre property is situated at the west end of Pearl lake and includes the greater portion of the lake. The rocks are largely light-coloured pearly schists, which are altered acid volcanics. Eyes of clear glassy quartz can occasionally be recognized in the rock, suggesting schistose quartz-porphyry.

In March last work was being carried on from three shafts. Of these, Nos. 1 and 4 are on the south side of the lake, 800 feet apart, while No. 5 is on the north side of the lake, 1,000 feet from No. 1. At the time No. 1 was the main hoisting shaft. This shaft is down 200 feet, with drifting at the 100 and 200-foot levels on the vein which is exposed on the surface. On the 200-foot level a cross-cut had been driven toward the ground under the lake, encountering other lenses of ore. Shafts Nos. 4 and 5 were also down 200 feet, with some development at this depth. In all about 3,600 feet of development had been accomplished. To the southwest of No. 1 shaft, on the 100-foot level and near the raise, quartz fills the width of the drift, is well seamed with secondary minerals, and shows visible gold at several places. In other parts of the vein schist and quartz constitute the ore body. Iron pyrites is abundant in the wall rock, along the contact of quartz and schist, and in crushed areas of the quartz. Most of the visible gold occurs in or along the crushed areas or along contacts of quartz and schist.

McIntyre mine, Pearl lake, Oct. 1911.

A stamp mill has been erected on the property and was in operation in March. The treatment of the ore is simple, involving amalgamation followed by concentration.

The ore is crushed in a 10 x 20-inch Blake crusher and elevated by a bucket conveyor to a 60-ton ore bin. From here it is fed to ten 1,250-lb. Chalmers and Williams stamps and crushed through 20-mesh screens. Amalgamation is done on six 48 x 60 inch plates, arranged in series of three to each battery of 5 stamps. Below the plates are amalgam traps of the Homestake type.

The pulp is then classified on hydraulic classifiers. The sands are concentrated on two Deister sand tables, while the slimes pass through three Callow cones to three Deister slime concentrating tables. The concentrates obtained are clean, consisting principally of iron pyrites with a little galena.

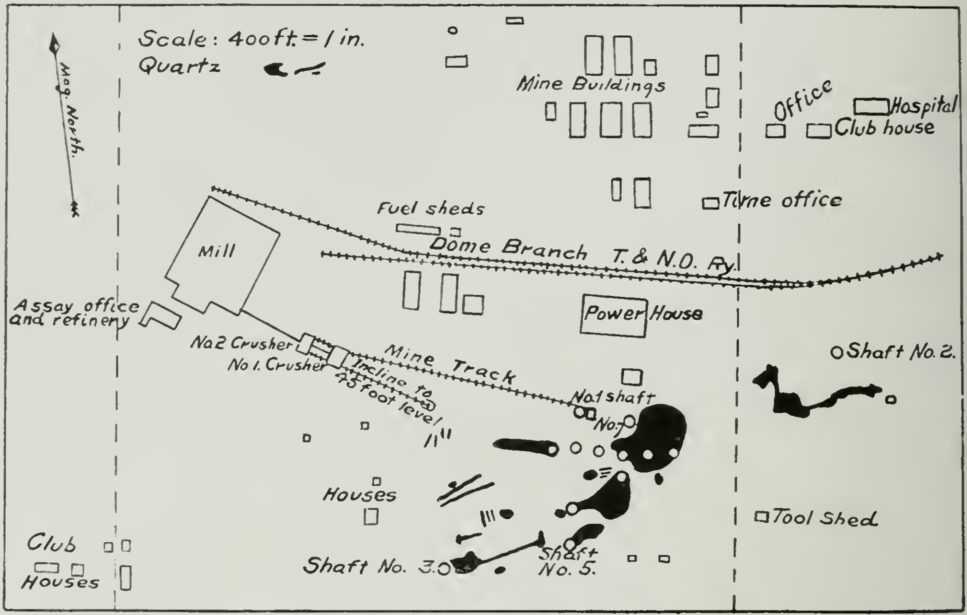
Plenaurum

Two shafts 200 feet in depth have been sunk on the property, which includes part of the east end of Pearl lake. From these shafts, which are on opposite sides of the lake, cross-cuts were being driven under the lake for exploratory purposes. Four quartz veins had been cross-cut at this depth. There are a number of quartz veins exposed on the surface to the northeast of Pearl lake which will be developed at depth from the northwesterly shaft.

Rea mine, looking N. W., Sept. 1911.

The Rea Mine

The Rea mine, which is situated about three-quarters of a mile northeast of Pearl lake, consists of parts of lots 6 and 7 in the second concession of Tisdale, which were originally taken up as veteran locations. A number of quartz veins have been discovered on the property, the most important of which is the No. 1 or Connell vein. This vein strikes N. 47° E. and dips steeply to the N.W. It has been exposed along the surface by trenching for over 200 feet, with considerable variation in width. The average width is given as 6 feet. The hanging wall as exposed near the surface is well defined, showing a movement along the wall with vertical grooves. The quartz along the wall has been greatly fractured, showing numerous slip planes and streaks of dark mineral, which are mostly parallel with the wall. It is in this fractured area that most of the gold occurs, along with iron pyrites and a little copper pyrites, which are the chief



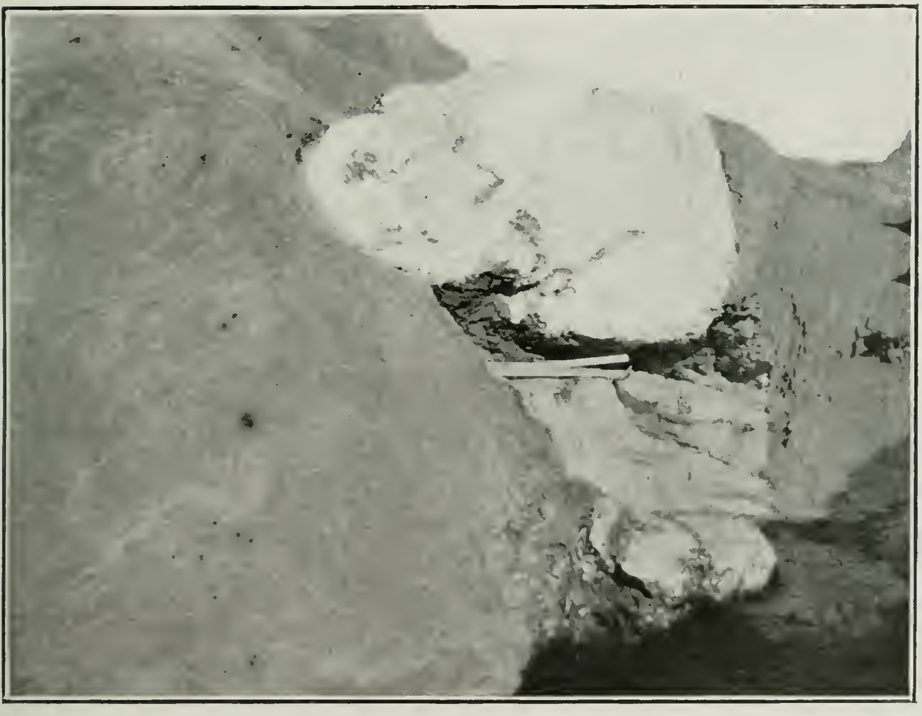
Surface plan of Dome mine. Bodies of quartz are shown in solid black. Shafts and raises are represented by circles.

Members of Canadian Mining Institute excursion party at Dome mine, March 11th, 1912.

sulphides. Under the microscope the mineral of the dark streaks is largely tourmaline, and along these streaks the quartz is very finely granulated and shows a dark bluish colour. An ore shoot, 200 feet in length, has been opened up on the 200-foot level. Here the lines of secondary fracturing are not confined to the hanging wall, but may follow the centre of the vein or the foot wall. Lateral quartz veinlets extend from the main vein into the foot wall. The wall rock is greenstone, impregnated with about 50 per cent. of ferruginous carbonate. Beyond the rusted rock in which the vein occurs, the main country rock is a greenish Keewatin rock, showing an ellipsoidal structure.

The vein has been developed by two shafts 130 feet apart. The Eakins shaft to the southwest has been sunk on the inclination of the vein to the 200-foot level. The main or Kingsmill shaft has been sunk vertically to the 400-foot level.

A minor fault crosses this shaft at about 40 feet in depth, displacing the vein below the fault, to the north of the shaft. Only a short cross-cut was made at the 75-foot level, as drilling about this time indicated the vein at a vertical depth of 228 feet. The shaft was immediately sunk to the 200-foot level, and a short cross-cut to the north-west intersected the vein. A drift on the vein at this level connects the two shafts. There is also a cross-cut and drift on the vein at the 300-foot level, while at the 400-foot level there is a cross-cut to the northwest. A winze was sunk 16 feet on the vein on the 200-foot level and a raise of 47 feet was made on the 300-foot level. Some diamond drilling was done on the two lower levels.



Part of "Golden Stairway" vein containing spectacular gold showings, Big Dome. The lenticular character of the deposit is shown, and rock enclosing quartz is slate. Oct. 1911.

The Dome Mines

This property consists of a group of six claims in lots 4 and 5 in the first concession, Tisdale. The main workings are on the northeast and northwest quarters of the north half of lot 4. The schistose rocks which enclose the ore bodies are of Temiskaming and Keewatin age. In that part of the ore body in which the large dome-like masses of quartz occur, there is a much altered slate conglomerate, and to the west Keewatin schist, which is much impregnated with carbonate and which also contains considerable sericite. In parts of the Keewatin there are amygdules of quartz and calcite, indicating an old lava. To the northeast of the dome masses the rock is a schistose greywacké, in which is the "Golden Stairway" vein. A band of schistose quartz-porphyry lies to the south of the ore body of the Dome, extending in a northeasterly direction to the Dome Extension.

The best gold values are along the contacts of quartz and schist, where visible gold is frequently seen. It also occurs in brecciated areas in the quartz. Some of the gold is very coarse in character, particularly in the surface showings of the "Golden Stairway" vein, where some streaks of gold have a thickness of about a quarter of an inch. Iron pyrites is abundant along the contacts, occurring in well crystallized forms in the schist contiguous to the veins. A little galena and pyrrhotite also occur in the vein.

Dome mines, Jan. 1912.

Development

During 1910 the development was largely confined to that portion of the property which includes the large dome-like masses of quartz and interfoliated lenses of quartz and schistose rock. The surface of this deposit was carefully sampled and a part of it tested by underground workings, consisting of 5 shafts, a raise, and some drifting and cross-cutting at the 45-foot level. The ground below this level was examined by diamond drilling. During 1911 a great amount of trenching was done to the northeast of the original workings, resulting in the discovery of the lens called the "Golden Stairway" vein; while the low-lying ground extending towards the Dome Extension was examined by diamond drilling.

Mining was also extended to greater depths. Shaft No. 5, located near the south boundary of the ore body, was sunk to the 100-foot level. A 3-compartment shaft, now called No. 1, was sunk at the north boundary of the ore body 110 feet; while shaft No. 7, 80 feet east of No. 1, has been sunk to the 200-foot level. Shafts Nos. 1, 5 and 7 are connected with the workings on the 45-foot level, and Nos. 1 and 7 on the 100-foot level. Some cross-cutting and drifting have also been done on the 200-foot level from shaft No. 7. Shaft No. 2, situated 100 feet north of the "Golden Stairway" vein, has been sunk to the 100-foot level. This shaft will be carried down 400 or 500 feet as soon as possible.

On the 45-foot Level

An incline from the crusher station, situated to the northwest of the ore body, to the 45-foot level is the main mine opening. It is 350 feet long and has a grade of 13.55 per cent. The incline is connected with the workings on the 45-foot level by a drift 240 feet long and 8 feet wide, which is double-tracked. The workings on the 45-foot level have been laid out in a rectangular arrangement. There are two main drifts, about 300 feet in length and 175 feet apart, which run nearly east and west. These are intersected by 4 parallel cross-cuts 100 feet apart, which have a slight grade toward the north main drift. This drift has a grade toward the incline, and is connected with the No. 1 shaft by a main cross-cut and two by-passes on either side of the cross-cut, making angles of 45° with it. Seven raises have been put up to the surface and with four of the old prospect shafts give eleven working places. Ore chutes have been constructed at the bottoms of the raises and shafts. The ore will be broken into these working places from the surface, and drawn from the chutes into V-shaped cars and trammed to the incline. Trains of 4 cars will be hauled up the incline to the crusher station by a single drum hoist requiring 15-horse power.

Narrow quartz veins in Keewatin carbonate schist at Dome property. Nov. 1910.

An electric driven compressor with a capacity of 1,200 cu. ft. of free air per minute is being installed. This will give sufficient power for the projected development work. In addition there is a convertible type compressor of 1,200 cu. ft. capacity which is at present being run by steam.

The Dome Mill

The following description of the flow sheet of the Dome mill is by Mr. Henry Hanson, mill superintendent:—

The ore from the mine is delivered to a No. 7½ Kennedy gyratory crusher. The product from this crusher is then carried a distance of 70 feet, by a 20-in. Robins troughed conveyor belt (19° incline), and passed over a grizzly to two No. 3 Kennedy gyratory crushers. The product from these crushers, together with the undersize from the grizzly, is conveyed, by a Weller 20-in. troughed belt, up a 20° incline, a distance of 160 feet, and passed to a horizontal conveyor of the same size and make. From this belt the ore is discharged at will to any part of the 16,000-ton steel bin by means of a two-way tripper (2 pulley, style "G").

From this bin the ore is drawn direct to the forty-1,250-lb. gravity stamps. The product from the stamps passes over 8 silver-plated copper plates, 4 ft. 6 in. wide by 12 ft. long, where the gold liberated in the primary grinding is amalgamated. The first plate tailings are then conveyed to four Dorr duplex, drag classifiers, where the coarse sand is raked into the tube mill feed sump. The fines or slime products overflow the lip of the classifier, and pass over 9 by 12 ft. silver-plated copper plates, of which there is one in front of each classifier. The discharge from the tube mills is returned to the classifiers.

The fines after passing over the secondary plates are laundered to three 30 by 10 ft. Dorr thickeners, or dewatering tanks, where the pulp is thickened to a consistency of about one to one. The clear water overflowing these tanks is pumped back to the battery supply, while the thickened slime is discharged into the boot of a 68-foot bucket elevator, where the cyanide is added, and conveyed to the first of four 8- by 40-foot Pachuca agitators. After passing through the series of four agitators, the pulp is drawn from the last into two 25- by 10-foot Dorr thickeners and thence to a mechanical emulsifier or agitator. From this agitator it is drawn to the Merrill slime presses.

The effluent gold solution from these presses goes to four 25- by 10-foot sump tanks, from which it is pumped through two Merrill triangular precipitation presses. The barren solution is stored in two 25- by 10-foot tanks for further use. The residues from the filter presses are flushed out into two 30- by 10-foot Dorr thickeners by means of a 11 by 12-foot Aldrich triplex pump. The clear water overflowing these thickeners is run into the pump storage tank for further use. The thickened slime, or bottom discharge, is run to waste.

Dome Extension

This property is situated a quarter of a mile northeast of the Dome mine. Rocks of the Temiskaming and Keewatin series occur on both properties. Diamond drilling has shown that the band of schistose quartz feldspar-porphyry which is exposed to the south of the Dome workings crosses the low land to the northeast to the Dome Extension. On the Dome the ore body lies to the north of the quartz-porphyry and is mostly in conglomerate and greywacké slate of the Temiskaming series.

At the Dome Extension a disturbed zone occurs to the east of the porphyry in schistose greenstone. No. 4 shaft has been sunk on this shear zone where there are surface outcrops of quartz masses and veins. This shaft has been sunk 100 feet and a cross-cut of 30 feet has exposed a mass of quartz with narrow veins which has been drifted on for 100 feet. In part of the quartz there is pyrrhotite and tourmaline, chiefly along the contact of quartz and schist. Some of the greenstone is impregnated with pyrrhotite. Visible gold occurs with the pyrrhotite and tourmaline and also in the white quartz near the contact. In other parts of this property the sulphide mineral is pyrite.

No. 1 shaft is situated 400 feet west of No. 4 and is also in schistose greenstone. This shaft was down 222 feet and about 400 feet of drifting and cross-cutting accomplished on the 100- and 200-foot levels, exposing some lenses of quartz. The cross-cut on the 200-foot level was to be extended northwest through the 300-foot wide porphyry band into the conglomerate and greywacké in which diamond drilling had indicated a disturbed zone with quartz lenzes. Owing to the depth of the drift to the west of the Dome Extension workings, diamond drilling had to be resorted to in order to show the extent and disturbance of the Temiskaming slate.

Dome Lake

The rocks at the Dome lake property are altered greenstones which are much impregnated with carbonate. Amygdaloidal and ellipsoidal structures are frequently seen on the surface. The schist strikes S. 85° E. mag. and dips N. 80°. Shear zones are very marked in an almost E. and W. direction. One shear zone constitutes vein No. 3, which is traceable over 1,000 feet by trenching and averages 3 feet in width. The country rock has been much altered in this zone by quartz and carbonate solutions. Strips of country rock are included in the secondary minerals, while iron pyrites is disseminated in fine crystalline form through the band. The gold generally occurs in an invisible state in close association with the iron pyrites.

Two shafts have been sunk on No. 3 vein 650 feet apart with some drifting at the 50-foot level. To the west of shaft No. C a lamprophyre dike 18 feet in width, with N. and S. strike cuts the schistose greenstone and veins.

North Dome mine, showing power transmission line; shot drill in operation. Oct. 1911.

Under the microscope a sample of vein consists largely of quartz and calcite in very fine grains, with considerable chlorite, which is evidently an alteration from the enclosing basic rock. Minute crystals of iron pyrites are abundant in the section. There are some small grains of gold in a free state, and in one of the larger grains of pyrite are several minute grains of gold.

North Dome

The workings at this property are on a low conglomerate slate ridge which outcrops from the surrounding drift. The sedimentary rocks strike S. 65° W. and dip steeply to the N. W. The rock has also a less marked dip to the N. E. The direction of the secondary cleavage is about S. 75° W. mag. Short narrow veinlets of quartz cut the schistose conglomerate at a low angle to the strike.

Two shafts were sunk in the conglomerate to depths of 60 and 70 feet with some cross-cutting and drifting at these depths. Narrow quartz veinlets were encountered, some of which dipped with the schist while others cut across it. The conglomerate near the veins is greatly silicified. Visible gold occurs in some of the quartz near the contact with the schist, and has been deposited on some of the crystals of pyrite, which are very abundant along the contact of quartz and schist. Some of the pyrite is of earlier formation than the gold.

Porcupine Lake Mining Company

This property, known as the Hunter claim, is situated on the east shore of Porcupine lake, to the south of Porcupine townsite. Only a very small area of rock was exposed immediately along the shore where visible gold was discovered in quartz and schist. Owing to the drift, surface trenching was resorted to in exploring the property, while several shallow pits were sunk. The ore does not occur in a definite vein, but rather in a disturbed zone which has a well defined foot wall. In this zone there is interbanded schist and quartz, while more defined quartz veins occur near the foot wall. The strike of the zone is N. E. and S. W., while the dip is 60° N. W. The disturbed zone has been recognized at intervals over 750 feet in length and was being tested by diamond drilling from the lake during the past winter.

Vein at Hughes property, Whitney township, showing series of lenses.

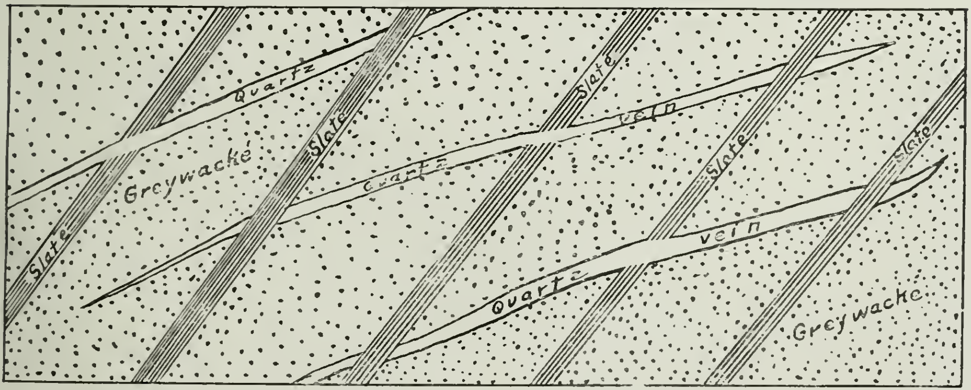
Davidson

This property is situated in the north part of Tisdale township. It was one of the earliest in which gold was discovered. The country rock is altered greenstone through which there are shear zones developed in east and west direction. In these zones the rock has been greatly altered, rendered schistose and impregnated with secondary carbonate, quartz and iron pyrites in cube form. The general dip of these bands is to the north at an angle of about 60°. In parts of these bands numbers of quartz veins or lenses have been formed, from mere veinlets up to several feet in width. For the most part these veins strike approximately with the schist and dip against the schist at low angles to the south. At the Davidson the shear zone is 90 feet wide and on the surface is much rusted by the oxidation of the iron in the carbonate. The ordinary greenstone has a light greenish weathered surface.

A shaft was down 170 feet with a 100-foot cross-cut to the north at the 100-foot level, and some drifting and cross-cutting on the disturbed zone accomplished. The shaft was placed near the south or foot wall of the shear zone, so that at 40 feet the zone dipped to the north of the shaft. One cross-cut over a distance of 27 feet shows many narrow quartz veins. Towards the south wall the veins are broader and have a higher dip. Visible gold occurs along the contacts of the quartz and carbonate rock. Crystallized iron pyrites is abundant in the rock near the veins.

Hughes

On this property situated in Whitney township there are lenses of quartz showing on the surface. These dip to the south across the schistose country rock. At the surface there is an enrichment along the north wall, where the quartz has been fractured and secondary solutions have run in. In a cross-cut to the south at the 50-foot level there is a quartz lens 11 feet in width, which shows an enrichment along the south wall of secondary quartz containing some visible gold. At about 70 feet in the shaft there is an impregnation of quartz stringers and iron pyrites in the schist, carrying some gold values.



Sketch showing how narrow quartz veinlets have in some cases not continued through the slaty bands of the Temiskaming series, at LaPalme property.

Three Nations Lake Mining Company

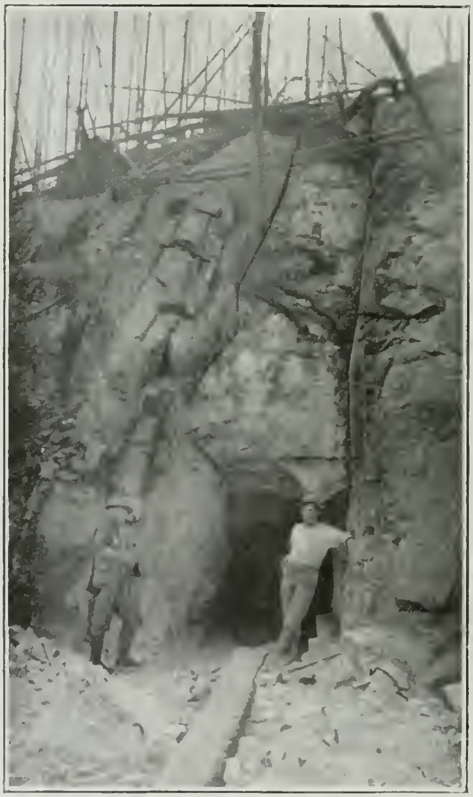
This property is situated in the northeast part of Whitney township, adjoining La Palme. A number of narrow quartz veins which showed visible gold were first found, and some shallow pits and trenches made on them. Later a quartz vein, averaging over 3 feet in width, with a strike N.E. and S.W., was discovered and a shaft sunk on it. This vein, which dips 70° S., left the shaft at 40 feet and, when the property was visited in March a cross-cut was being driven at the 100-foot level to cut the vein. Below 75 feet in the shaft a number of quartz veins, with low dip to the S., came in. Visible gold was noted in the quartz from these veins. On the surface the main vein can be traced for 300 feet. Over part of its length it conforms to the strike of the schist, but towards the southwest cuts across it. Considerable iron pyrites and zincblende occur with the quartz in parts of the vein.

A shaft was also sunk on the contact between the serpentine and conglomerate on the north line of the property, where the rock has been greatly silicified and also impregnated with carbonate and iron pyrites. Material from this shaft gave gold values on assay.

La Palme

On the La Palme property there are a number of narrow quartz veinlets, varying from a fraction of an inch up to 7 inches in width. Showings of coarse visible gold occur in a number of the veins. The strike of the veins varies from that of the enclosing conglomerate and greywacké. The rocks dip steeply to the N., whereas the veins dip to the south at about 45°.

The forces which produced these narrow veins must have acted very gently. Veins have been formed which can be traced through quartzitic bands ending abruptly at the slaty band, and continuing beyond in another quartzitic band. The fissures were more readily produced in the brittle quartzite than in the tough slate.



Barite vein on property of Premier Langmuir Mining Co., Langmuir township.

Silver in Langmuir Township

The property of the Premier Langmuir Mining Company is situated in the township of Langmuir, along the south boundary and immediately west of Night Hawk river. On the property is a prominent ridge of Archean rock, which rises about 125 feet from the surrounding drift. The rock enclosing the veins is principally Keewatin greenstone schist. To the south there is intrusive reddish syenite in some volume. Narrow dikes of syenite cut the greenstone, and both rocks are cut by veins of barite. These veins occur along the northeasterly slope of the Archean hill. The main vein has been traced about 1,000 feet in a direction somewhat south of east, while a branch vein has been followed about 350 feet with an E. and W. strike. The main vein would average from two to three feet in width, and at one place has a width of eight feet.

A tunnel has been driven on the main vein at its westerly end a distance of 100 feet. The vein matter shows barite, with sparingly disseminated galena. Much of the barite is very pure in appearance, but portions of it contain calcite. About 500 feet east of the tunnel a shaft has been started on the branch vein, where it shows a width of 50 inches. Towards the south wall of this vein, where a cut had been made for the shaft, there are a few streaks or bunches of dark minerals. These consist principally of black or brown zincblende and galena, and in addition there are scattered flakes of native silver and argentite. Iron and copper pyrites also occur sparingly. It was noted in the pit on the east vein that the barite was cut by some minute veinlets of quartz, along which most of the sulphides occur. This would suggest that the sulphides along with the silver came in with the quartz. Fluorite has been obtained in some narrow cross veinlets from the larger vein. The barite veins have well-defined walls, and the filling breaks freely from the wall rock. A quantity of commercial barite could be obtained from these veins for use in the manufacture of paints, etc.

No smaltite or bloom was seen in the vein matter, but bloom was obtained about one mile to the west. Some small areas of diabase occur in the vicinity, but not immediately near the Keewatin area in which the veins are found.

Assistants and Acknowledgments

Messrs. E. L. Bruce, P. E. Hopkins, A. F. Mahaffy and R. M. Smith acted as assistants during the season of 1911. In addition, Mr. Hopkins assisted in preparing the report and accompanying map.

The topographical part of the survey was in charge of Mr. W. R. Rogers, the topographer of the department.

The assays and analyses mentioned in the report were made by Mr. N. L. Turner, Provincial Assayer.

The writer is indebted to the managers of the various mines and prospects for rendering assistance in the examination of the properties, and to the mining recorders, Mr. A. E. D. Bruce and Mr. J. A. Hough, for maps, plans, etc.

WATER POWERS IN THE PORCUPINE AREA

By W. R. Rogers

For the last report of the Bureau of Mines the writer prepared a few notes[1] on the subject of water powers in the vicinity of Porcupine. This article was incorporated in Mr. Burrows' report on the Porcupine Gold Area.

Since last writing the hydro-electric plant at Sandy Falls has been completed, and electric energy supplied to the mines since June, 1911. Another water power is being harnessed at Wawaitin Falls. Both of these powers, situated on the Mattagami river at distances of 6 and 11½ miles respectively from the Hollinger mine, are shown on the geological map of the Porcupine area.

Other water powers within a radius of 25 miles from Porcupine are: High Falls on the Frederickhouse river in the township of Mann; Grassy Falls on the Price-Fripp township boundary; and Sturgeon Falls on the Mattagami river in the township of Mahaffy. Applications have been made for permission to develop all of these. However, no actual development work has been carried beyond the stage of preliminary surveys.

General view of dam, spillway, flume and power house of Porcupine Power Co., Oct., 1911.

A copy of the regulations stating the conditions upon which water powers are leased may be had on application to the Department of Lands, Forests and Mines.

Importance of Accurate Data

Hydrographic work in Canada, or rather the branch of it pertaining to stream measurements, was initiated by the Department of the Interior, Ottawa, in 1909. Work, however, has been confined almost exclusively to Dominion lands in the Province of Alberta. A valuable report was issued in 1911 by the Conservation Commission, entitled "Water-Powers of Canada." In this volume emphasis is laid on the necessity of obtaining more accurate data in regard to water powers before proceeding with their development. The only safe basis for estimating the maximum amount of power available is the minimum flow of the stream throughout the year. In some cases storage facilities will help to raise this minimum. In order to secure the necessary data, metering and gauging stations should be established, and to ascertain the maximum, minimum and mean discharges accurate records for a period of years are necessary. The importance of winter observations must not be overlooked, as the minimum flow occurs during that season and should be determined for use in considering power schemes. From the power user's point of view contracts should not be entered into for the supply of more power than is justified by low water records for a period of ten years or more. As such data respecting water powers in northern Ontario is not available, a very conservative estimate should be made the basis of hydraulic and electrical installations.

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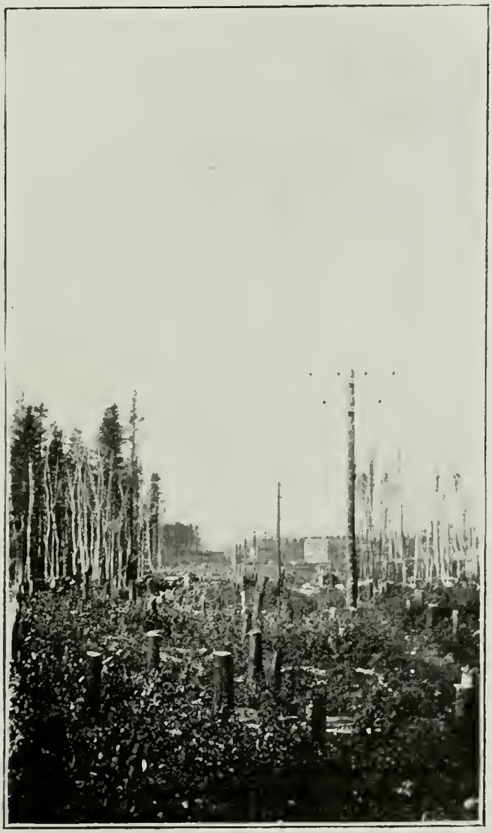
[1] Bur. Min., Vol. XX. (1911). Part II. page 32.



Transmission line of Porcupine Power Co. through Timmins townsite, Oct. 1911.

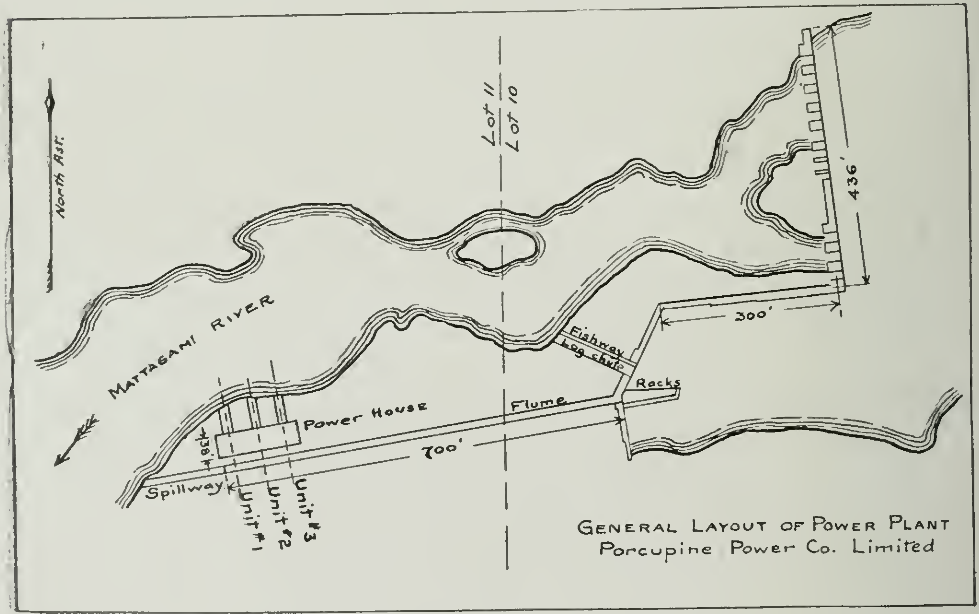
A case in point is that of the Porcupine Power Company. Extreme low water and ice troubles in March, 1912, combined to tie up the Sandy Falls power plant and to greatly inconvenience customers. A year previous, at the Ragged Chutes compressed air plant on the Montreal river, a similar condition developed, which resulted in many of the mines at Cobalt shutting down for lack of air to run the drills. This difficulty has been overcome by the construction of storage dams to retain flood waters, in order to increase the flow at low stage periods.

The drainage area of the Mattagami river at Wawaitin Falls is approximately 1,000 square miles. At Sandy Falls the drainage area has been increased to 2,500 square miles by the additional territory supplying tributary feeders, namely, Mountjoy creek and the Grassy and Lost rivers. Assuming a run-off of 0.4 cubic feet per second per square mile, the discharge at these points would be 400 and 1,000 cubic feet per second, respectively. The effective head at Wawaitin is 118 feet, and at Sandy Falls 34 feet. Figuring on this basis and assuming for turbines 80 per cent. efficiency, under natural flow, the minimum 24-hour horse power is 4,300 and 3,100 respectively. The only definite metering records available give the following:—

Wawaitin Falls.—March, 1910, 366 cubic feet per second.

Sandy Falls.—January 20th, 1910, 1,654 cubic feet per second.

A director of the Porcupine Power Company states that the extreme low water flow per second at Sandy Falls was 1,600, 1,200 and 600 cubic feet, respectively, for the years 1910, 1911 and 1912. It will be seen from the above records that an exceptional year like 1912 emphasizes the necessity of continuous records for a period of years to ascertain the extremes of flow as well as a reliable mean. Extreme cold weather, with no thaws of consequence throughout the winter, produces an acute situation in northern Ontario. Controlled storage is the only remedy for increasing the minimum flow, and it is proposed to dam the headwaters of the Grassy river for this purpose. In this part of the Province of Ontario February and March is the season of extreme low water.



General Layout of Power Plant
Porcupine Power Co. Limited

In the case of the Wawaitin plant, Kenogamissee lake forms a small storage basin. Kenogamissee Falls, 25 miles south, affords facilities for storage and regulation. In addition, it would be possible to divert the Lost or Redsucker river by means of a small dam and a shallow cutting about 1½ miles in length through sandy soil.

Porcupine Power Company

The Porcupine Power Company's plant at Sandy Falls consists of two 25-cycle, 3-phase, 12,000-volt, 214 revolutions per minute, 950-k.w. generators, directly connected to S. Morgan Smith turbines. A third unit of similar capacity is being installed. The electric equipment is of Canadian Westinghouse manufacture. Each unit requires 450 cubic feet of water per second to develop full power under an effective head of 34 feet.

Turbine runners are 54 inches, and intake pipe 10 feet in diameter. The turbines were specially constructed to admit of sections being teamed on sleighs a distance of 45 miles from Kelso before the Porcupine branch of the T. & N. O. railway was built. The power house is a timber structure sheeted with galvanized iron, and is equipped with a 15-ton travelling crane. The timber flume, 13 by 16 feet in section, and 700 feet long, is provided with electric heating wires running through the upright studs in case it should be found necessary to use a heating appliance to prevent ice formation in extreme winter weather.

The dam is of cribwork construction, stone filled, sheet piled, and has 10 sluiceways, varying in width from 12 to 16 feet. Spillway, fishway, and a combination ice-run and log chute are also provided.

The plant was designed and constructed by H. D. Symmes, of Niagara Falls, who is a director of the Porcupine Power Company.

Wawaitin Power Company

Construction work at Wawaitin falls started in the summer of 1911. Supplies, machinery, etc., were loaded on scows and pointers and towed up the Mattagami river by gasoline boats from Mattagami Landing. Messrs. Ross and Holgate, of Montreal, are consulting engineers for the company.

Interior view of power house, showing units 1 and 2, Porcupine Power Co.

The Falls are in Thornloe township, their position being shown on the map of the Porcupine Gold Area. It is proposed to use a head of 118 feet, carrying the water from a higher level to a lower by means of an open flume and pipe lines. The open flume or canal is about 1,400 feet long, 40 feet in width, and the greater part is in rock. A 12-foot diameter penstock leads from the flume for a distance of 1,500 feet, where it subdivides into two, each 8 feet in diameter and 1,200 feet long. The surge tank at the junction of the penstock is 40 feet in diameter and 38 feet high. These 8-foot penstocks terminating at the power house supply two units, each Westinghouse generator being 2,500-k.w., 12,000-volts, 3-phase, 25-cycle, running 375 revolutions per minute, with an overload capacity of 3,120 k.w. Provision has been made for a duplication of the pipe lines and power house installations. The power house is of reinforced cement construction, with cement roof.

Part of Wawaitin falls on Mattagami river.

Pipe line excavation, looking north-east towards site of power house, Wawaitin falls, Nov., 1911.

The location of the dam is at the head of a small island, at the point where Kenogamissee lake contracts to river width. This dam, 1,000 feet long, is provided with log chute, 150-foot spillway, and has 16 stop-log sluiceways for the purpose of maintaining a uniform head above the dam.

E. A. Wallberg has leased this water power, and under the conditions must develop electrical energy to the amount of 4,000-h.p. by September, 1912. During the past winter, 1911-1912, progress has been checked for financial reasons. However, at the time of writing, May, 1912, work has been resumed and indications point to completion of the work before the time required by the lease from the Crown. An interest in the power company has been acquired by the Dome Mines, Limited. They will require 3,000 horse power for the first year's work.

The Sandy Falls plant of the Porcupine Power Company is already taxed to the limit of its capacity, and further power must be provided to meet the demands of Porcupine mines as development proceeds.

Thanks are due Mr. Robert Laird, resident engineer of the Wawaitin Power Company, for furnishing construction data. Mr. J. H. Thornley, resident engineer of the Porcupine Power Company, kindly supplied photographs of the power house and general layout, and also explained the main features of construction.

THE SWASTIKA GOLD AREA [1]

By E. L. Bruce

The Swastika gold area centres about the town of Swastika at mileage 164 on the Temiskaming and Northern Ontario railway. The area examined comprises the southern half of the township of Teck and the northern half of the township of Otto. This area was first described by Mr. W. J. Wilson, who made a reconnaissance survey of the Blanche river for the Canadian Geological Survey, and later by Mr. L. L. Bolton, who accompanied Speight's survey party in 1904 and reported on the geology of the country from Round lake to Abitibi for the Ontario Bureau of Mines.

At the time of the gold rush to Larder Lake a number of claims were staked in the Swastika area, and some work was done upon them. The claims now held by the Lucky Cross Mining Company and those of the Swastika Mining Company were located at that time. In the depression which followed operations were continued only on the latter group. The first development was done on the big quartz vein on the west side of Otto lake. A shaft was put down about sixty feet and some drifting done. Surface prospecting on the north side of the lake uncovered No. 1 vein, containing visible gold, and with the discovery of other veins near this one the work on the west side was abandoned. A shaft was sunk and a five-stamp mill was installed on the north side. This mill turned out several small bricks before being dismantled in 1911 to make room for the present plant.

The discovery of gold at Porcupine led to renewed interest being taken in the older area, and the summer of 1911 saw most of the old claims restaked and development work started on many properties.

Topography and Drainage

The area lies just south of the height of land between James Bay and the Ottawa river, and while the difference of elevation is seldom more than two hundred feet the country is rather rugged and broken. Rock outcrops are numerous, and the areas of swamp are neither large nor continuous. The hills are arranged in roughly parallel east and west ridges in conformity with the strike of the formations. East of the Blanche river, however, the regularity is not so pronounced, and the hills are more or less isolated.

The Blanche river, which flows through this area, turns sharply east about a mile below Kenogami station and runs between two of these ridges until it breaks across the southern one in a series of rapids at Swastika. Just south of these rapids it is joined by Amikougami creek, which forms the outlet of Amikougami lake north of Swastika, and which flows in a fairly straight north and south course. Below the junction of the two streams is a broad valley, in which the river meanders considerably before entering Otto lake. Leaving the lake, the river again forms a series of rapids, below which there is a long stretch of quiet water broken only where it crosses the syenite ridge in concession IV. In concession V. the Blanche receives another tributary from the north, known as Murdock creek. This stream, like Amikougami creek, flows south in a fairly straight course. The lower part is shallow and rapid, but the upper reaches are rather sluggish. The Amikougami is broken by a few rapids, but forms a good canoe route to the lakes lying to the north.

Geology

The rocks of the area may be classified as follows:—

RECENT AND GLACIAL:—

Stratified clays, peat, sand and gravel.

PRE-CAMBRIAN:—

[2]Post Huronian.—Diabase, red feldspar-porphyry, augite-lamprophyre.

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[1] This report is accompanied by a geologically colored map of the area described.

[2] The term post Huronian in this report indicates that the intrusive rocks embraced under it are later in age than the sedimentary Huronian rocks of the area described. It is not to be inferred that these intrusives are younger than certain Huronian rocks that occur in other areas. Definite correlation is impossible at present.

Igneous Contact.

Huronian.—Conglomerate and greywacké.

Unconformity.

Laurentian.—Augite syenite.

Igneous Contact.

Keewatin.—Gray feldspar-porphyry, basic intrusives, iron formation and epidotic rocks, greenstones and schist.

Keewatin

Greenstone and greenstone schist.—The greater part of the Keewatin rocks are massive greenstones or their schistose derivatives. Where still massive, the greenstones show an ellipsoidal structure. This characteristic is pronounced in the rocks of the northeast corner of Otto. It is also seen especially well on the hill to the east of mile-post 170, and on the face of the cliff near Kenogami station. Massive greenstones grade into rocks of schistose character. The schistosity becomes more pronounced near the contact with the later acidic intrusives, and the strike of the schists is usually parallel to the strike of the contact. The layers of schist are not at all regular, but often the rock shows a columnar structure, with twisted blocks whose surfaces are serpentinized and highly polished. Rocks of this type outcrop along the railroad east of Amikougami creek. Between this stream and Murdock creek, railroad cuttings show an anticlinal arrangement of these schists. At the western side they have a strike S. 45 W., dip 70° N.W. The dip gradually becomes less steep, until the schists are almost flat. Then the dip increases towards the S.E., and at a point two miles east of Swastika the strike is S. 64° W., dip 80° S.E.

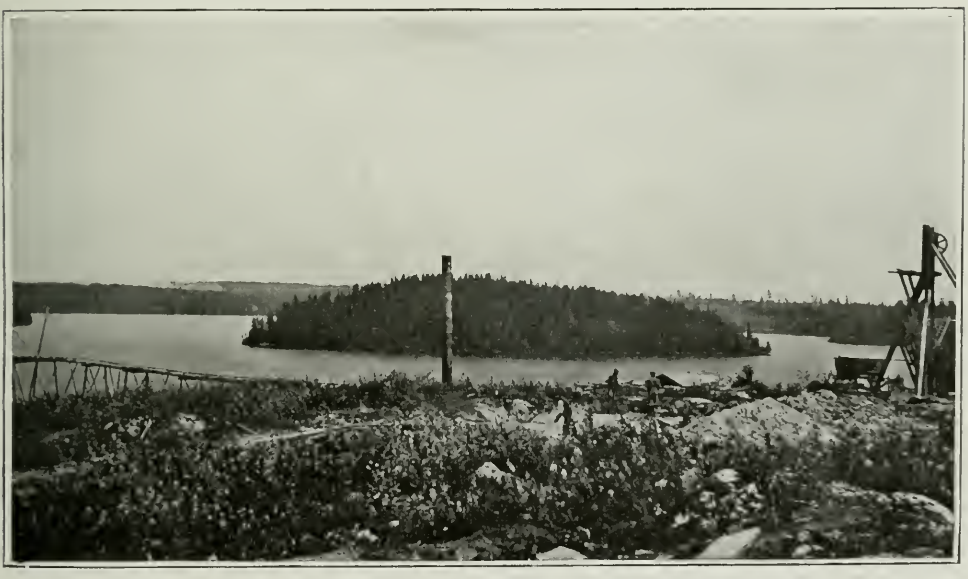


Photo by C. Spearman.

Otto lake from Swastika mine.

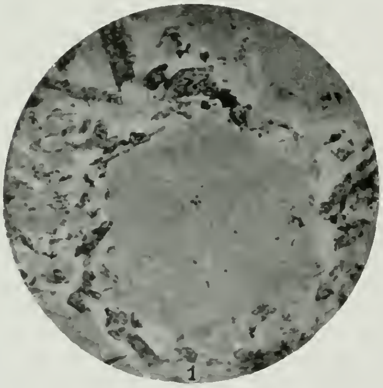
The greenstones and schist extend in a broad belt across concessions IV. and V., Otto, and after crossing the Blanche river at Swastika the northern boundary follows Amikougami creek for some distance, and then swings northeast across the southern part of the township of Teck.

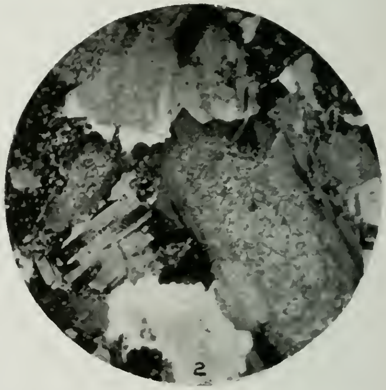
A schistose greenstone east of Swastika consists entirely of actinolite needles, along with sericite and magnetite. A rather more massive rock at the west end of Pike lake has altered to chlorite, with a considerable quantity of carbonates, and has fine particles of sulphides scattered through it. In neither case is any trace of the original structure or minerals left.

At mileage 162 on the Temiskaming and Northern Ontario railway there is a cutting through a very dense black basaltic looking rock that carries many small lenses of sulphides. Under the microscope the rock shows grains of quartz and a dark sooty material. The rock suggests a baked bituminous shale.

Carbonate Rocks.—Carbonates occur at several places in the area. Along the north side of Pike lake a narrow more or less continuous band of a much rusted carbonate rock separates the conglomerate from the gray feldspar-prophyry. This band is so altered and its character so masked by the rusty weathering that it is impossible to determine its original nature. In parts the unweathered portion is light green in colour, probably consisting largely of the chrome-bearing mica, fuchsite. Carbonate rocks also outcrop farther west, in lot 12, concession VI., Otto. They are fractured and the fractures are filled by quartz, producing a network of intersecting veinlets. Other small outcrops of carbonate rocks occur in the eastern part of Teck.

Serpentine.—The greenstones are often much serpentinised along slip planes and on the surfaces of the layers of schist. An outcrop of massive serpentine of small extent was observed on the Crawford claims, about two miles north of Swastika.





Iron Formation and Epidotic Rocks.—Banded iron formation, consisting of alternate bands of magnetite and silica, occurs at several points along the southern edge of the Keewatin belt. A rock that seems to be related to it is exposed in the railway cuts in concession V., Otto. This rock consists of interbanded epidote and silica. Iron formation lies a few chains farther south.

Keewatin Intrusives.—A large number of dikes of varying character cut the Keewatin greenstones. Some of these are so much altered that they suggest very early intrusions, and probably belong to the latter part of the Keewatin complex. Others, however, are much fresher, and may be of much later date. These are relatively small in area and have been mapped as Keewatin, since their relationship to later rocks is not known.

Diabase dikes are very numerous in the greenstones. In most cases the rock is very badly altered, and there is little doubt that it belongs to the Keewatin complex. Other dykes are, however, quite fresh in appearance, and some of these may belong to the post-Huronian series, but at no place was any intrusion of diabase into conglomerates or greywackés observed. A considerable area of a massive igneous rock outcrops in concession V., lots 1 and 2, of the township of Eby. It is somewhat altered, but still retains phenocrysts of a bronzy color. Farther north a thin section shows a rock that has evidently resulted from the metamorphism of an igneous rock of a porphyritic type. Some original minerals are still recognizable, and the original structure is not much affected. Feldspar phenocrysts are present and can still be determined as near albite in composition. A few shreds of green hornblende are left, but most of this mineral, which apparently formed the largest number of phenocrysts, has changed over to chlorite. Sericite is also abundant, due to the alteration of the feldspathic constituents.

Feldspar-Porphyry.—Intruding the greenstones near Otto lake and again on the eastern side of Murdock creek is a gray feldspar-prophyry, which has been included in the Keewatin series. The feldspar phenocrysts show distinctly on the surface. Under the microscope the rock is distinctly porphyritic (figs. 1 and 2). The phenocrysts are plagioclase feldspar, near the albite end, set in a groundmass of quartz, feldspar, and hornblende. Considerable alteration has taken place, producing chlorite, sericite, kaolin, carbonates and epidote. Magnetite and chalcopyrite are present. The phenocrysts make up a large part of the rock, the areas of groundmass being narrow.

An analysis of this rock gave:—

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	K_2O	Na_2O	CO_2	H_2O	Total.
60.71	14.87	3.26	3.60	3.52	3.29	2.52	4.40	1.68	2.35	100.2

This calculates to a norm consisting of:—

Quartz.	Orthoclase.	Albite.	Anorthite.	Magnetite.	Chloride	Kaolin.	Sericite.	Hornblende.	Total.
17.34	11.10	37.16	1.67	1.20	12.93	4.82	3.14	7.70	100.84

This shows the acidic nature of the feldspar. The large quantity of chlorite present explains the rather high percentage of water in the analysis.

Other sections examined exhibit almost complete alteration of hornblende to aggregates of chlorite and epidote. A thin section of the rock in the railway cut near the water tank at Swastika shows a rather abnormal facies of this rock. Here the ferro-magnesian minerals are altogether lacking, the whole rock consisting of albite, quartz and alteration products such as carbonates, sericite, chlorite, epidote and magnetite. The ordinary type is a quartz diorite-porphyry. This abnormal type approaches a quartz keratophyre.

Hornblendite.—Crossing the eastern boundary of Teck is an outcrop of porphyritic hornblendite. It is roughly elliptical in outline and is entirely surrounded by drift, hiding the contact with the Keewatin rocks around it. Near the centre of the exposure, the hornblende crystals are large, often being an inch in diameter, and the whole rock consists of dark minerals. Towards the margin it becomes finer grained, and more light coloured constituents appear. The rock is made up of phenocrysts of green hornblende and brown biotite, with a little magnetite, apatite and titanite. Inclusions of light pyroxene, of the variety diopside, occur in the hornblende crystals. There is very little alteration, and the hornblende is undoubtedly primary. The little secondary material present is epidote, aparently from feldspar. The unaltered character of the rock suggests that it may be much later than the Keewatin series, possibly a basic segregation from one of the acidic intrusives.

Other Intrusives.—Many other smaller dikes cut the Keewatin at different places in the area. Basaltic dikes from an inch up to sixty feet in width are to be seen in the railroad cuts east of Swastika. In one of these cuts a dike of andesite-prophyry six feet in width intrudes the serpentinised greenstones. It has a very striking porphyritic structure. The phenocrysts are feldspar and hornblende. The former are well bounded tabular crystals of albite showing zonal structure. The hornblende is of the ordinary green variety, occurring in prismatic crystals much elongated. Cross sections of these have diamond shaped or hexagonal outlines, and some of the crystals show distinct zonal growth, an uncommon feature in hornblende. Fragments of biotite, now light green in colour from alteration, and, in some places, completely altered to chlorite and magnetite, occur. Apatite is also present.

A dike of similar rock but showing more alteration occurs on the Reeves claims north of Pike lake. This dike is cut by a narrow mica-lamprophyre consisting almost entirely of greenish biotite, with a little magnetite.

Laurentian

All those rather fresh, acidic rocks of the area, whose relationship to the conglomerate is not known, are included in the Laurentian series. In the northwestern part of the district conglomerates were found overlying acidic igneous rocks, although not directly in contact, and containing pebbles very similar to the underlying formation. In other places no relationship was observed. The character of the feldspar, and the presence of augite in the syenite classed as Laurentian, suggests that it may be one member of a series of differentiation products of a parent magma, of which red feldspar-porphyry and augite-lamprophyre, to be described later, are other facies. In the absence of any observed field relationship, however, it has been mapped as Laurentian.

There are three areas of such rocks in the district. The largest of these forms a prominent ridge lying between concessions IV. and V., Otto, and extending east and west. A boss-like mass intrudes Keewatin rocks north of the railway with its centre in H. R. 737. The third is a small exposure south of Perron lake, in the northwestern part of the area.

The contact of the first of these with the Keewatin can be seen in the western part of the township, forming a broad zone. Towards the centre and east, however, the Laurentian ridge is separated from Keewatin rocks by a wide drift-filled valley. The rock consists largely of feldspar, and is often very coarse in grain, the feldspar reaching a diameter of an inch or more. The coarse grained rock is cut by finer grained stringers of the same character, excepting for the size of the constituents. These withstand weathering rather better and stand out from the surface. The cleavage of the feldspars causes the rock to break down rather easily. In thin section the rock exhibits a tendency towards porphyritic structure. It consists of feldspar, augite, biotite, hornblende, magnetite, zircon, apatite and titanite. Quartz is present in the small areas of groundmass that separate the feldspar phenocrysts, but is not very abundant. Chlorite, epidote and secondary hornblende occur as alteration products. The augite is the oldest of the more important constituents, occuring as well formed crystals (Fig. 3), and sometimes as inclusions in the feldspar. The pyroxene is often fringed with uralite. The most striking characteristic of the rock sections is the structure of the feldspar. It has a peculiar ragged, almost brecciated, appearance, which seems to be due to a crude micro-perthitic intergrowth. An analysis of the finer grained part of this rock gave the following composition and norm:—

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	K_2O	Na_2O	H_2O	Total.
61.65	18.91	2.37	1.48	1.11	2.10	4.20	5.59	0.60	98.01

Quartz.	Orthoclase	Albite.	Anorthite.	Magnetite.	Chlorite.	Biotite.	Hornblende and Pyroxene.	Total.
6.30	18.72	47.20	5.50	1.70	2.50	10.05	6.23	98.20

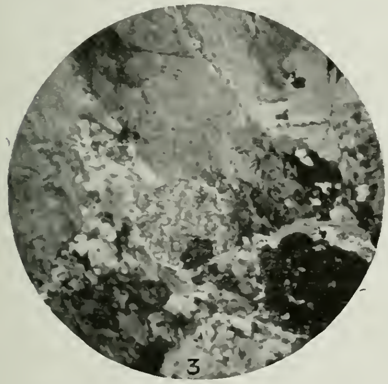
The rock is essentially an augite syenite-porphyry.

The second Laurentian area consists of syenitic rocks of similar character, but the feldspars do not attain so large a size. The rock of the third area is not so coarse in grain as that of either of the others, and shows a more distinctly porphyritic texture.

Huronian

Huronian rocks occupy the western part of the township of Teck from the boundary line north to the limits of the map sheet and east as far as Swastika. Northeastward from Swastika the contact with the Keewatin is along the course of the Amikougami creek. It then swings eastward again. The Huronian forms a rather high area, rising gently to the north for a mile and a half from the Blanche river, and then breaking into a series of east and west ridges.

For the most part, the series consists of conglomerate and greywacké. These are fresh and unsqueezed away from the contact, but, along the borders of the formation, the rock is a slate standing at a high angle and much rusted and altered. At a short distance from the contact, a conglomerate and greywacké are quite fresh in appearance. It may be possible that the highly tilted slates represent a series older than the fresher conglomerate, or the relation of the Huronian to the Keewatin may be that of a fault contact.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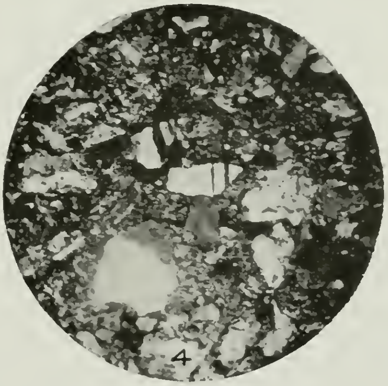
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The conglomerate is very massive and shows no bedding. It varies considerably even in short distances, being crowded with pebbles at one place, while a few feet away pebbles are so rare that only careful search will reveal them. Most of the pebbles are well rounded, evidently water worn, fragments of feldspar-porphyry, similar to the gray feldspar-porphyry already described. Reddish, felsitic pebbles also occur and a few pieces of granite were found. Greenstones are common, and fragments of smooth serpentinised rock like that east of Swastika also occur. The most striking constituents of the conglomerate, although less in number than the others, are the pebbles of jasper varying from the size of a pin-head or less up to a diameter of four or five inches.

Where pebbles fail, the rock passes into a typical massive greywacké. Near the western boundary of Teck, the typical greywacké grades into a reddish colored rock of an arkose type. Thin sections of a typical variety show fragments, most of which are porphyry, with feldspar or green hornblende phenocrysts. Along with these are fragments of minerals, consisting of albite, quartz, hornblende and magnetite set in a matrix of finer material of the same kind. Secondary minerals, chlorite, sericite, and kaolin are present. (Fig. 4.)

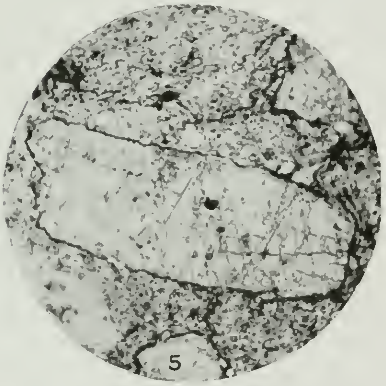
Post-Huronian Intrusives

There are at least two igneous intrusives that are later than the sedimentary rocks. These are of distinct types and their relation to each other is not known. Both occur as dikes cutting greywacké and conglomerate, and sometimes as masses of considerable area.

One of these is a light reddish rock with a tendency to develop feldspar phenocrysts. A small knob of this rock is encountered in the first railway cut west of Swastika. It extends but a short distance south of the railway, and sends off a tongue along the base of the hill of conglomerate that rises south of the right-of-way. The conglomerate along the contact is considerably altered and the pebbles squeezed and drawn out. East of Amikougami creek is another small exposure of similar rock, and on the Costello claim a small exposure of greywackê is cut by at least three different dikes of this rock. Many other small dikes of the rock occur at different places in the conglomerate.

A specimen from the cut west of the station shows under the microscope a rather granitoid texture, and consists almost entirely of an acidic plagioclase feldspar with a considerable quantity of secondary products. Dolomite is the chief of these, occurring in small rhombohedrons massed together, or in veinlets through the feldspar.

Aggregates of epidote and other secondary minerals are present and a little chalcopyrite is scattered through the section.



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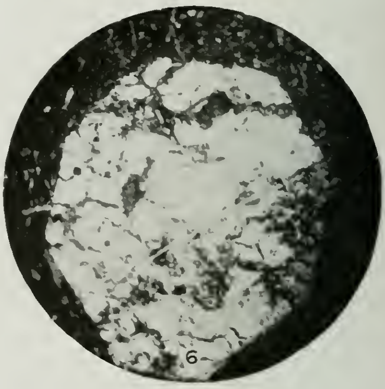

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The analysis of the rock and the norm, are as follows:—

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	K_2O	Na_2O	CO_2	H_2O	S	Total.
56.25	18.42	1.56	2.41	2.38	6.13	0.32	8.10	4.58	0.22	0.10	100.47

Quartz	Orthoclase.	Albite	Anorthite.	Magnetite.	Chlorite.	Kaolin.	Hornblende.	Pyrite.	Dolomite.	Total.
0.66	1.70	68.20	12.28	1.20	1.70	0.30	4.62	0.30	9.63	100.54

This shows over 80 per cent. feldspar. The small quantity of orthoclase probably unites with some of the soda to form anorthoclase. Hornblende does not occur in the sections examined, and that shown in the norm represents minerals such as epidote, chlorite, and other secondary products.

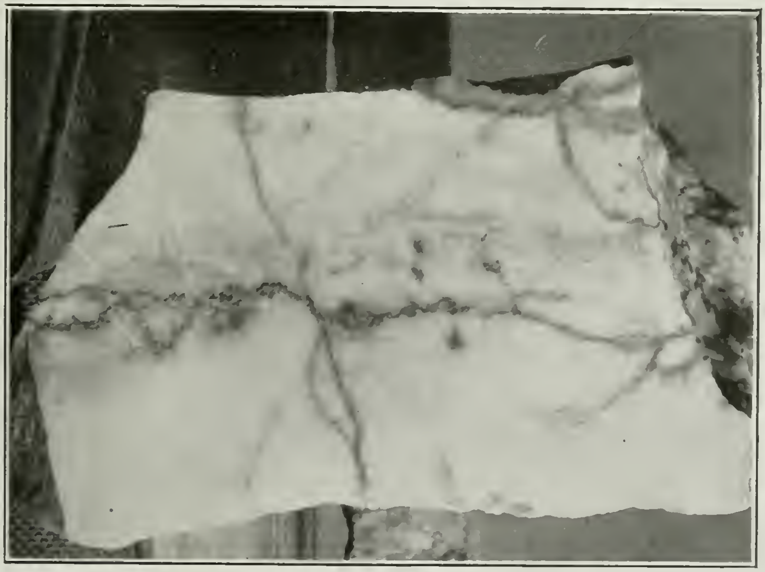
Augite Lamprophyre.—The other post-Huronian intrusive is basic in character. It is black and weathers with a pitted surface. On a fresh fracture it sometimes shows a faint purple shade. Parts of the rock show aggregates of secondary minerals which give it the appearance of having an amygdaloidal structure. This general character suggests rock of the Keewatin complex, but on a small point on the south shore of Elsie lake, near the west end, a narrow dike of this rock striking northeast cuts the greywacké. Other dikes of the same rock occur at points on the trail north to this lake, and some of these include fragments of Huronian in them.

On the north bank of the Blanche river in the township of Eby, augite lamprophyre forms the face of the high bluff for some distance. The contact is on the top of the ridge and near it the lamprophyre is brecciated and recemented by the same kind of rock.

Thin sections show numerous phenocrysts of augite set in a groundmass made up of needle-like feldspars and smaller augite crystals. Magnetite is scattered throughout in considerable quantity, also apatite. both as inclusions in the phenocrysts and the groundmass. Chlorite and epidote occur as alteration products. The augite is green in colour and occurs in well formed blocky crystals (Fig. 5 and 6). The feldspears are too small to be determined optically. The apparently amygdaloidal portions mentioned before are areas of secondary minerals, but they seem to be replacements of certain parts of the rock rather than fillings of vesicular spaces. The analysis of this type, and its composition as recast, are as follows:—

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	K_2O	Na_2O	H_2O	Total.
52.29	19.38	4.40	6.00	3.54	7.79	4.12	2.12	0.95	100.52

Orthoclase.	Albite.	Anorthite.	Magnetite.	Chlorite.	Kaolin.	Pyroxene.	Total.
24.00	17.86	28.07	2.80	5.05	2.99	19.55	100.32



Photograph of quartz from the Swastika mine. Quartz shows dark streaks in crushed areas. Iron pyrite is abundant along the dark lines, along with visible gold. Length of sample, 3½ inches.

Since the kind of feldspar could not be determined, the relation of augite to anorthite as calculated may not represent the true proportions of the rock.

Pleistocene and Recent

The Pleistocene is represented only by unsorted sands and gravels, and these do not exhibit great development in the area. Since Pleistocene time the streams have formed alluvial plains in favorable places along their valleys. The largest of these is along the Blanche river in concession V, Otto. In the swampy and marshy areas between the rock exposures peat has formed to some depth. South of the area, towards Round lake, the Pleistocene and recent deposits are a much more important formation.

Economic Geology

The rocky and broken character of the country makes it quite unsuitable for agriculture, excepting in the limited areas where streams have formed alluvial flats. Farther south, near Round lake, some farms have been taken up.

Fires have destroyed the original forest, but the part north of the Blanche river supports a considerable second growth, mostly of birch and poplar. This is rather light near the river, but becomes denser farther north.

Gold

Visible gold occurs in quartz veins in at least two parts of the district. One lies near Otto lake and includes the Swastika mine and the Reeves claim. The other lies east of Amikougami creek, on the Lucky Cross Mining company's claims.

The veins are of the usual rather lenticular type, as a rule with steep dips. The quartz is of the white crystalline variety, with dark streaks showing in it. A slight fracturing follows the first quartz deposition, and tiny veinlets of a more transparent variety cut across the older quartz, like water lines on paper. Sulphides occur in the veins, as chalcopyrite and pyrite. The gold is very often associated with the sulphides or with the dark lines in the quartz, but occasionally is found in the clear quartz. On the Swastika claims the veins cut greenstone and gray feldspar-porphyry. On the Reeves and neighboring claims the wall rock is feldspar-porphyry and the rusty carbonate rock. The relationship on the Lucky Cross veins is similar to that on the Swastika. The porphyry is in small dikes and sometimes forms one wall, occasionally for a short distance both walls, of the vein, which does not seem to vary with change of country rock.

Swastika mine with Lucky Cross mine in the distance.

Veins of very similar physical characteristics are found in the conglomerate and greywacké, but, so far as known, no values have been found in them. It may be possible that they are of different age than the veins found in the Keewatin rock, or, if of the same age, the Keewatin rocks have favored precipitation of values where veins cut them. If the latter explanation is correct, it seems likely that the fracturing of the rock and deposition of the vein material and gold values is due to the post-Huronian intrusive rocks, and probably more to the acidic type than to the augite-lamprophyre.

Active Properties

The Swastika Mining Company has done most of its development work on three veins on the north side of Otto lake. The largest of these is eight to nine feet wide, striking north and south. This is intersected by two other veins, the smaller having eight to nine inches of quartz. Most of the ore already stoped has come from the large vein above the thirty-five foot level. The mine now has a three-compartment shaft down two hundred feet, the old shaft being used merely for ventilation. Considerable drifting has been done. A new equipment has been installed, consisting of two 125-horse-power Jenckes boilers, a 10 by 12 double drum hoist and a 12-drill Sullivan compressor.

On the Reeves claims north of Pike lake, two veins, eight and nine feet wide, have been stripped for a hundred feet or more. These veins strike N.E. and S.W., and are about fifty feet apart. In the larger of the two, visible gold occurs at its junction with the small quartz vein.

On the Lucky Cross claims visible gold was found first in a small vein that shows in the railway cut just east of Amikougami creek. North of the right-of-way this vein is about eight inches wide and carries visible gold in a band crossing the vein at an angle from wall to wall. Later prospecting has uncovered other veins north of this, one of which has a width of twelve feet. A plant including a 6-drill compressor has been installed.

The Homestead Mining Company has a vein in the rusty carbonate rock near the Huronian contact, on which they are driving an adit into the hill.

The observations on the area were made under the general supervision of Mr. A. G. Burrows, who spent a few days with the writer in the field. Mr. R. M. Smith acted as assistant during the season. Valuable advice and assistance in the petrographic determinations were received from Prof. C. P. Berkey, while the data were being worked up in the Department of Geology and Mineralogy at Columbia University.

CRIPPLE CREEK GOLD AREA

By W. R. Rogers, Topographer; and E. L. Bruce, Geologist

The Cripple Creek area referred to in the following report, comprising parts of the townships of Whitesides, Carscallen, Keefer and Denton, lies about twenty-five miles to the southwest of Porcupine. Township lines in this section, formerly unsurveyed territory, were run in 1910 by H. J. Beatty, O.L.S. During the same season a hasty geological examination was made by A. G. Burrows, assisted by E. L. Bruce, and a sketch plan showing the mapped area appeared in Mr. Burrows' report on the Porcupine Gold Area.

Renewed interest in the vicinity, coupled with the fact that the information regarding the lakes and canoe routes was very inaccurate, justified further topographical mapping and geological examination. Accordingly, a small party, consisting of A. Mahaffy, R. M. Smith, E. L. Bruce and W. R. Rogers, spent four weeks in the district during the summer of 1911. Reference to the accompanying map will show that some parts of the area were not examined.

Routes

Several routes starting from Porcupine offer means of access to the region. Motor boats run from Mattagami landing to Bristol landing on the Mattagami river. From the latter point a wagon road leads to the McAuley-Bridge claims four miles to the west. Trails are then followed into Carscallen and Denton townships.

The northerly parts of Whitesides and Carscallen may be reached by a trail leaving the Mattagami river at the south boundary of the township of Mountjoy and extending westward, following O. L. S. Niven's base line of 1899.

Prospectors with interests in Whitesides and Keefer, and in the unsurveyed areas to the southwest, canoe to a point 1½ miles above Wawaitin falls on the Mattagami river, from which a portage of 1⅝ miles leads to the Lost or Redsucker river. This river is ascended as far as Cripple creek, which enters about one mile west of the east boundary of Denton. The lower part of Lost river, through Thorneloe and Bristol, is a succession of rapids for 4½ miles, impossible for canoes going upstream, but affording an exciting trip down stream during high water periods. Cripple creek would be a misnomer were it not for the fact that canoes making the trip either up or down stream usually emerge from the ordeal in a crippled condition. Rapids are long and numerous, and in low water the boulder-strewn bed of the stream offers a very shallow and narrow passage.

In the west part of Thorneloe township the Lost river presents some rapids, which inexperienced canoemen avoid on the upstream trip by taking a longer portage route, leading from Joe Moore's cabin on Kenogamissee lake to the head of the swift water on Lost river. Reference to the map of the Porcupine gold area will show these several trails and canoe routes.

Drainage and Topography

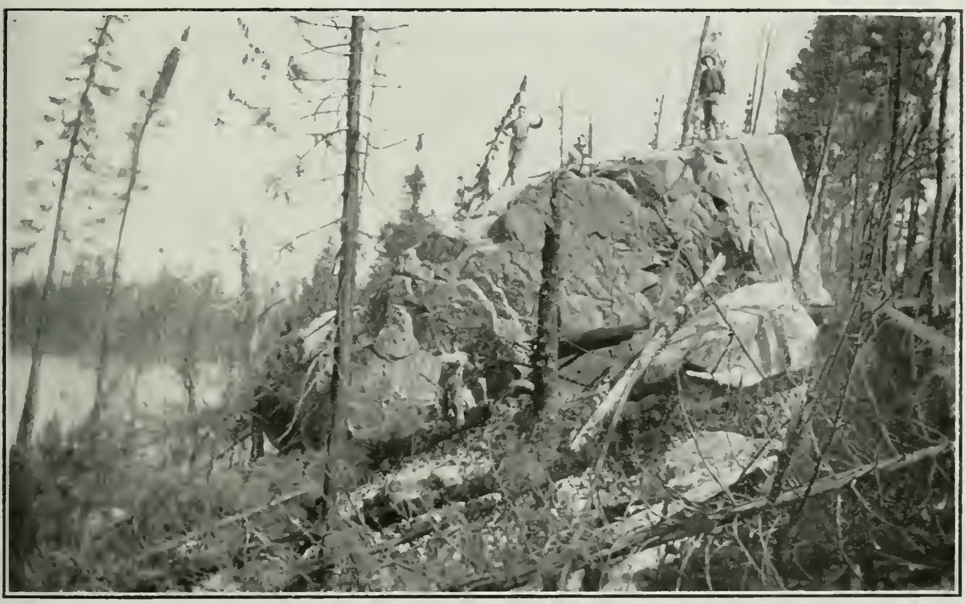
The whole area is one of low relief, with few prominent features. The region is so level that excepting along the streams it remains undrained and swampy. The general elevation rarely exceeds fifty feet above the lakes. One notable exception is the conical hill in Denton, three-quarters of a mile east of the centre milepost on the west boundary of the township. Another prominent ridge lies between Turtle and Wallingford lakes, in the township of Whitesides. Both of these are rock exposures of Keewatin age. Lying between the valleys of the Kamiskotia and Lost rivers is a series of lakes. Of these the three largest, Jowsey, Dana, and Star, find their outlet in Cripple creek.

The following elevations are based on T. & N. O. railway surveys:

Kenogamissee lake, 1,008 feet above sea level.
Otter lake, 1,116 feet above sea level.

The elevations of other lakes included in the four townships are aneroid and hand level determinations based on the railway datum:

Redsucker river (at end of portage leading to Kenogamissee lake), 1,015 feet.
Carlton lake, 1,055 feet.
Sedge or Mud lake, 1,060 feet.
Star lake, 1,065 feet.
Dana lake, 1,075 feet.
Jowsey lake, 1,080 feet.
Turtle lake, 1,085 feet.
Levalley lake, 1,065 feet.
Opishingquaqua lake, 1,050 feet.



Large erratic boulder of gray granite, south bay of Star lake.

This particular section is distinctly glacial in character, with a very imperfectly developed system of drainage. Though water is abundant throughout the area, the valleys of the smaller streams are shallow and ill-defined. The lack of systematic relation between ridges and hills on the one hand and stream valleys on the other indicates drift rather than rock formation. In addition, the marshiness of certain tracts at relatively high elevations shows that the physiography was not shaped primarily by the erosion of running water.

Special phases of ground-moraine topography are everywhere in evidence. Numerous examples of *drumlins*, elliptical hills formed from glacial débris, may be seen on the west shore of the southwest arm of Star lake. These are elongated in the direction of the ice movement, a few degrees west of south, and present steep ends at their northern limits.

On the east shore, opposite the drumlins, a ridge of glacial formation paralleling the shore line presents a striking appearance. The hog's back has been burnt over, exposing to view numerous erratic boulders of massive proportions. They are mostly of gray granite formation, and probably have not been moved very far by the glacier

The accompanying illustration shows one of the largest of these, having approximate dimensions of 15 x 20 x 30 feet.

Dana lake owes its irregular outline to long north and south ridges of glacial sands and gravels. A typical esker splits the south part of the lake into two arms. This narrow curving ridge, formed of glacial detritus, is cut transversely by the Whitesides and Keefer boundary. The lake itself, a beautiful sheet of exceptionally clear water, island-studded and forest-bordered, stands out in pleasing contrast to most of the other lakes of the locality, which in general have low-lying and fireswept shore lines, presenting a desolate and uninviting appearance.

In addition to the undeveloped drainage between lakes of this chain, the streams that exist are very small in comparison with the size of the lakes. It is quite probable that a large part of the drainage from lake to lake is accomplished by seepage through the narrow sand and gravel ridges that separate them.

Lost river has a drainage area about equal to the Grassy. Both are tributary to the Mattagami, and join it from opposite directions in the southeast corner of Ogden township. The Kamiskotia is not as large a river as either of the above mentioned, but presents the same general characteristic common to nearly all streams in Archean areas, that is, the alternation between long lake-like expansions with little current and short contracted portions accompanied by heavy rapids and falls, thus affording good stretches of navigable water, with portages between. Opishingquaqua lake is simply an expansion of the Kamiskotia river.

Pine grove, east side of Star lake.

Through the township of Whitesides the Kamiskotia affords poor canoeing, owing to a series of falls and rapids. The greatest fall is 26 feet at the chutes near the centre of the township. This same low east and west ridge also appears on the Lost river in Thornloe and Bristol, at Wawaitin falls on the Mattagami, and at the falls of the Grassy on the Price and Fripp boundary. As yet none of these rivers have eroded valleys, and only in a few places have they cut through the glacial débris. As a result many of the rapids are difficult to run, owing to boulder-filled stretches of fast water.

Soil

The four townships are not promising from an agricultural standpoint. A great part of the overburden is either sandy, stony or swampy in character. The swamps and low land are generally found a short distance back from the waterways. They are heavily moss-covered and sometimes underlaid by a considerable thickness of peat, but more frequently with a bed of boulders. An occasional knoll of clay or sand projects through these poorly drained swamp areas. As stated elsewhere in the report, rock exposures are neither numerous nor extensive.

Fauna

Owing to fires the region is almost destitute of game. Beaver are numerous, however. Star and Dana lakes afford good fishing. Pike up to 30 inches in length were caught, and trout trolling is good in Dana lake in spring and fall. Pickerel and pike may be caught in pools below rapids on all the rivers.

Forests and Fires

Fires have destroyed the original forest over a large part of the area. The northern parts of Whitesides and Carscallen escaped the fires of 1910 and 1911, although an extensive old brulé exists to the west and north of Kamiskotia chute in the centre of Whitesides. The west part of Denton is almost entirely brulé of several years' standing. Fires were general throughout the region in 1910, but the most disastrous was that of July, 1911, which swept a considerable area in northern Ontario.

Spruce, jack pine, poplar and birch are the most common trees. The township outline surveyor in 1910 reported a fair stand of red and white pine west of Otter lake. This may have been destroyed in whole or in part in 1911, as that part of Keefer was not examined. Another grove of pine that has escaped is situated on the east side of Star lake. The illustration shows that this cut of about one-half million feet of lumber has had its fringes destroyed. Many of the trees in their struggle for life were pouring out pitch to heal the fire wounds. Scattered pine and smaller groves exist in other parts of the township of Whitesides.

Geology

Exposures of rocks are neither frequent nor very large. Hence the following divisions are made entirely on the character of the rock, no contacts having been observed between the more important formations.

GLACIAL AND RECENT:—
  Peat, unsorted sands and gravels, and more or less sorted sands and clays.
  Unconformity.
POST-LAURENTIAN:—
  Diabase dikes.
  Igneous contact.
LAURENTIAN:—
  Gray granite. Reddish gneissoid granite.
  Igneous contact.
KEEWATIN:—
  Greenstones, schists, diabase and iron formation.

Keewatin

A few exposures of schist occur on the Redsucker and Cripple creek, but the rock shows only along the banks of the stream. In the western part of Denton, on and near the Godon claims, a considerable area of Keewatin rocks is exposed. They are typical greenstones, in places showing a marked banding, which strikes east and west. Keewatin rocks also outcrop in small areas on the boundary between Carscallen and Whitesides north of the four-mile post. A large hill lies just east of the four-mile post and extends for an undetermined distance eastward. It is composed of altered diabase, Another large exposure of greenstone forms the divide between Turtle and Wallingford lakes, in the township of Whitesides, and other smaller exposures occur near Green lake and Weisman lake. Forming the eastern shore of the latter is a ridge of rather fresh-looking rock. In thin section it is a granophyric intergrowth of quartz and orthoclase, with a little magnetite, sericite, and kaolin. It is not very badly altered and seems to be much later in age than the Keewatin series. No contact between it and other rocks was observed. A small exposure of banded iron formation occurs east of H.S. 1031 in the township of Carscallen. At the chutes of the Kamiskotia a rock that is mostly hornblende occurs. This is probably also Keewatin in age.

Laurentian

Two types of rock are referred to the Laurentian. One of these is a somewhat gneissoid red granite. In thin section it is granitoid in texture, consisting of quartz, orthoclase, microcline albite, and biotite, with secondary magnetite, kaolin and hematite. The biotite occurs as shreds, often bent and sheared. Small outcrops of this rock occur both east and west of Lost river on the south boundary of Denton.

The other type is a massive gray granite. Under the microscope it is very similar in structure to the red granite gneiss. The biotite, however, is in rather larger shreds and is not bent or twisted. These two rocks were not found in contact with each other, and there were no rocks observed that seemed to be a transition of one to the other.

The gray granite outcrops near the centre of the four townships. A considerable exposure of it occurs on the south side of Cripple creek, west of the point where the creek from Carlton lake joins the main stream. Other exposures occur on Carlton lake and on the claims east of the lake. It also outcrops on Jowsey, Sedge, and Dana lakes, and at several places along Cripple creek.

Post-Laurentian

Cutting the Keewatin rocks and the granites are many diabase dikes. These are usually less than a chain in width and almost invariably strike north and south.

On the lower part of Lost lake are several outcrops of a fine-grained, massive rock, which is of sedimentary origin. It has been very much altered, however, and its appearance suggests its correlation with the Temiskaming series.

Economic

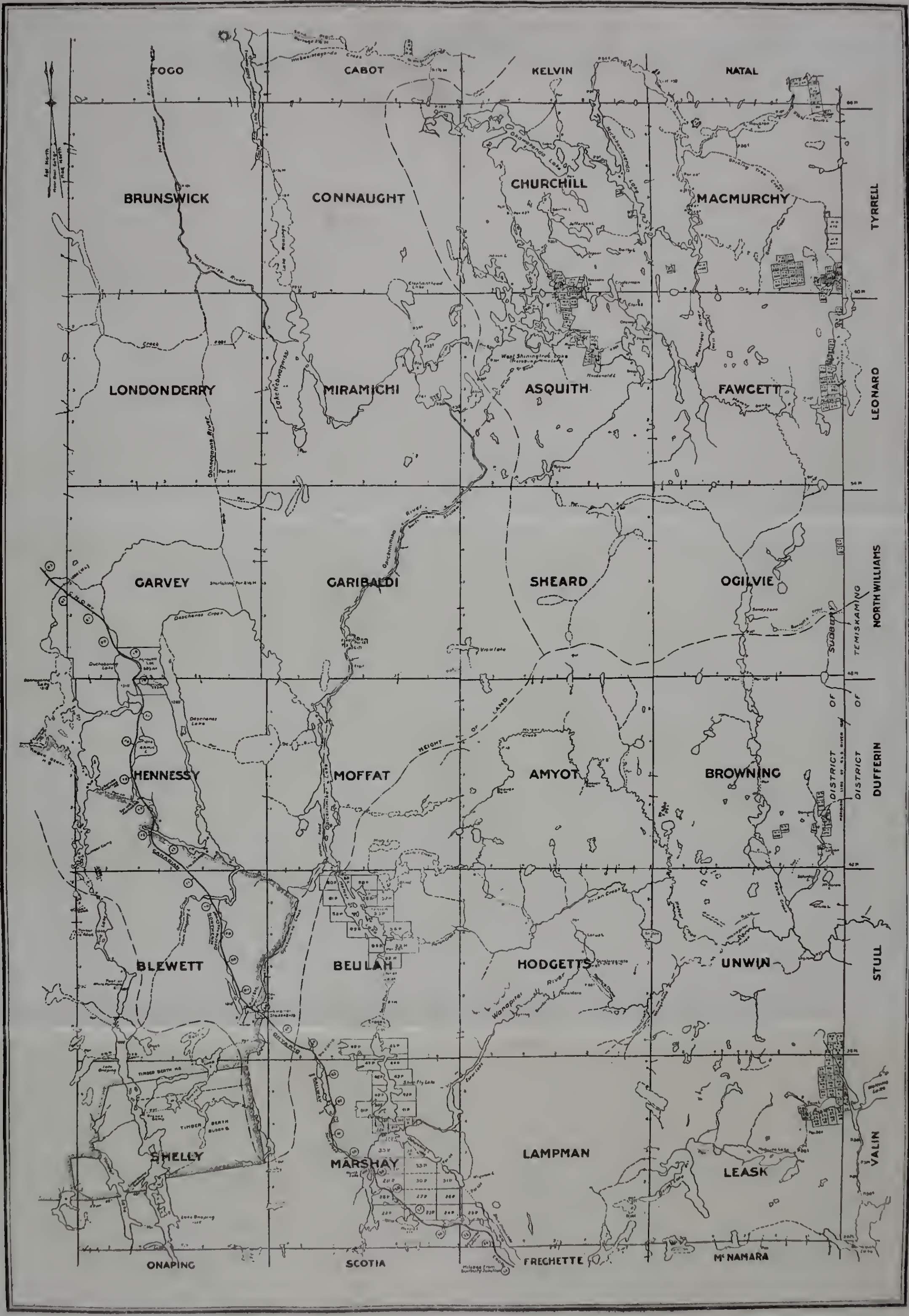
Quartz veins occur both in the rocks of the Keewatin age and in the gray granites. So far as could be found, none of any size have yet been discovered in the red gneissoid granite. Roughly, the strike of veins both in the Keewatin and the granite is east and west. The quartz of the veins in the greenstones has a distinctly bluish tinge, while that in the veins in the granite is white. Assay values are obtained from both types, and visible gold is said to occur. Pyrite is found quite plentifully. The veins in the Keewatin are of the usual lenticular type. Those in the granite, while more regular, are usually narrow, seldom exceeding six inches of quartz, with a band of rusty rock three or four inches wide on either side. Often there are three or four narrow stringers parallel to each other. Near the northeast corner of Whitesides a vein was observed one wall of which is a dike of diabase. The vein is apparently later than the dike.

MAP
OF THE

WEST SHININGTREE AREA
DISTRICT OF SUDBURY

SHOWING ROUTE FROM CANADIAN NORTHERN ONTARIO RAILWAY
TO ACCOMPANY REPORT OF G. G. STEWART IN THE TWENTY FIRST REPORT
OF THE BUREAU OF MINES ONTARIO 1912

SCALE
½ 0 2 4 Miles



WEST SHINING TREE GOLD DISTRICT

By R. B. Stewart

Late in August of 1911 the writer was instructed by the Provincial Geologist to proceed to the West Shining Tree District, where discoveries of gold had been reoprted from time to time in the daily press, and to make a brief examination of the geology of the district and the character of the deposits.

Location of the District

The area visited is situated in the Sudbury Mining Division, and includes the townships of Asquith, Churchill, MacMurchy and Fawcett. Wasaquagama or West Shining Tree lake, near which discoveries of gold were first made, lies in the townships of Asquith and Churchill. It is about 70 miles north of the town of Sudbury, 60 miles south of Porcupine, and 20 miles southwest of Gowganda.

Route to West Shining Tree Lake

West Shining Tree lake was reached by the Canadian Northern railway from Sudbury to Gowganda junction on Blue lake, and by canoe the rest of the way. From Gowganda junction the railway diverges from the canoe route, but parallels it in a general way, for about twenty miles, being never more than four or five miles distant. At the time the trip was made the railway beyond Gowganda junction was under construction. When a train service is established farther along, ingress to the district will be much easier.

The railway station at Gowganda junction is located about ten chains from Blue lake, which is a narrow body of water with steep banks, and extends in a northwesterly direction for nearly four miles. From its north end a portage of 55 chains, across a sandy plain with a steep ridge of sand running east and west, leads to Wigwam lake, and a portage of 15 chains connects the latter with Oshawong lake. This lake is one and a half miles long, and from the north end a portage of 14 chains joins it with Shoo Fly lake which runs almost north and south, and is about three miles in length. A nine-chain portage leads to Cross lake. From this lake a portage of one mile running north reaches the first of a series of four small lakes or ponds connected by short portages. All these extend in a northerly direction. The last of the small lakes is joined to Meteor lake by a portage of twenty chains. This lake is nearly three miles long and extends northwest. A portage of six chains over a gravel ridge at its north end connects it with Opickinimika lake, which extends north for almost six miles. The Opickinimika river flows from the north end of the lake, and the route follows the river until near the centre of the west boundary of the township of Asquith, a distance of about twelve miles. Leaving the lake, the general direction of the river is northeast for 8 or 9 miles, when it turns almost at right angles to the northwest. About one and a half miles from Opickinimika lake, a lift-over avoids a small rapids, and a short distance farther a portage of thirteen chains passes a falls forty feet in height. Below the falls there is a stretch of three or four miles of good paddling, but in the next two miles frequent rapids occur. The bed of the river at these places is covered for the most part with rounded boulders. At the time the trip was made the water was so low that it was necessary to wade the rapids and in some places to remove the load from the canoe in order to pass in safety. A short distance below the rapids the river turns to the northwest. About three miles below the bend the route leaves the river on the east side by a portage of 30 chains over low marshy ground into Allin lake. A portage of twenty chains connects this lake with a small one to the northeast. From here another portage of 20 chains leads into a small creek flowing north into West Shining Tree lake.

Topography

The route to West Shining Tree lake from Gowganda junction, as far as the north end of Meteor lake, passes through a level country heavily covered with sand and gravel. The only rock exposures that were observed in this distance are on the east shores of Blue and Oshawong lakes. A full description of the district traversed by this portion of the route is to be had in Dr. Coleman's report[1] on the placer claims that were located around Shoo Fly and Meteor lakes several years ago.

The portage betweetn Meteor and Opickinimika lakes crosses the height of land between the waters flowing towards the Great Lakes and those tributary to the rivers flowing into James bay. The route continues through the territory draining northwards until the portage leading northeast from Allin lake is reached, when it passes into the basin of the Montreal river. The country along this portion of the route is of a level nature, but the rocks are exposed in several places.

The area around West Shining Tree lake is one of low relief. No prominent elevations occur, but the general level of the country is well above the numerous small lakes of the district. The area for the most part is not heavily drift covered, but owing to the level nature of the ground the rocks are not exposed extensively except in parts that have been burnt over.

The forest growth is chiefly spruce, jack-pine, balsam, birch and small cedar.

West Shining Tree Lake, from which the district derives its name, is a very intricate body of water with low shores that are wooded to the water's edge. The lake drains northwards into lake Okawakenda.

Geology

With the exception of the rock exposures on Blue and Oshawong lakes which have been described by Dr. Coleman,[2] no outcrops were observed along the route to West Shining Tree lake until the north end of Meteor lake was reached, where granite was found. Outcrops of granite occur along the route until the small lake south of West Shining Tree lake is reached, where a hornblende schist occurs that appears to form a contact zone between the granite and the Keewatin rocks extending northwards. The granite area extends eastward, as granite was found on the east side of Granite lake, and northward down the Montreal river about a mile from the portage leading from Granite lake. Continuing east from this lake by way of the Montreal river across the township of Fawcett, granite outcrops were found at intervals until near the first small lake on the route to Shining Tree lake, where rock considered to be Keewatin greenstone was observed.

The area around West Shining Tree lake is underlain with rocks of Keewatin age cut in several places by diabase of a later age. The former extend north to Lake Okawakenda and along the north shore of the latter lake to Lake Michikawakenda where they occur along its eastern side to the Montreal river. Outcrops of similar rocks were found across the township of MacMurchy by way of Beaver creek and Shining Tree creek as far as Shining Tree lake.

These rocks may be described in a general way as greenstones and altered diabases, occurring in massive and schistose forms together with relatively small areas of porphyry, felsite and syenite. The felsites may include altered rhyolites and acidic tuffs and the greenstones may include basalts and andesites. It is difficult to give some of these highly altered rocks specific names. The schistosity has been developed locally in zones that have a general east and west direction, probably in the majority of cases running a few degrees north of east. The dip in most cases in nearly vertical. These shear zones are, as a rule, more mineralized than the massive rock, and are often accompanied by numerous quartz stringers.

Carbonate Rocks

In several parts of the district the rocks contain carbonates, which in some places compose the greater part of the rock. Iron carbonate must be present in considerable

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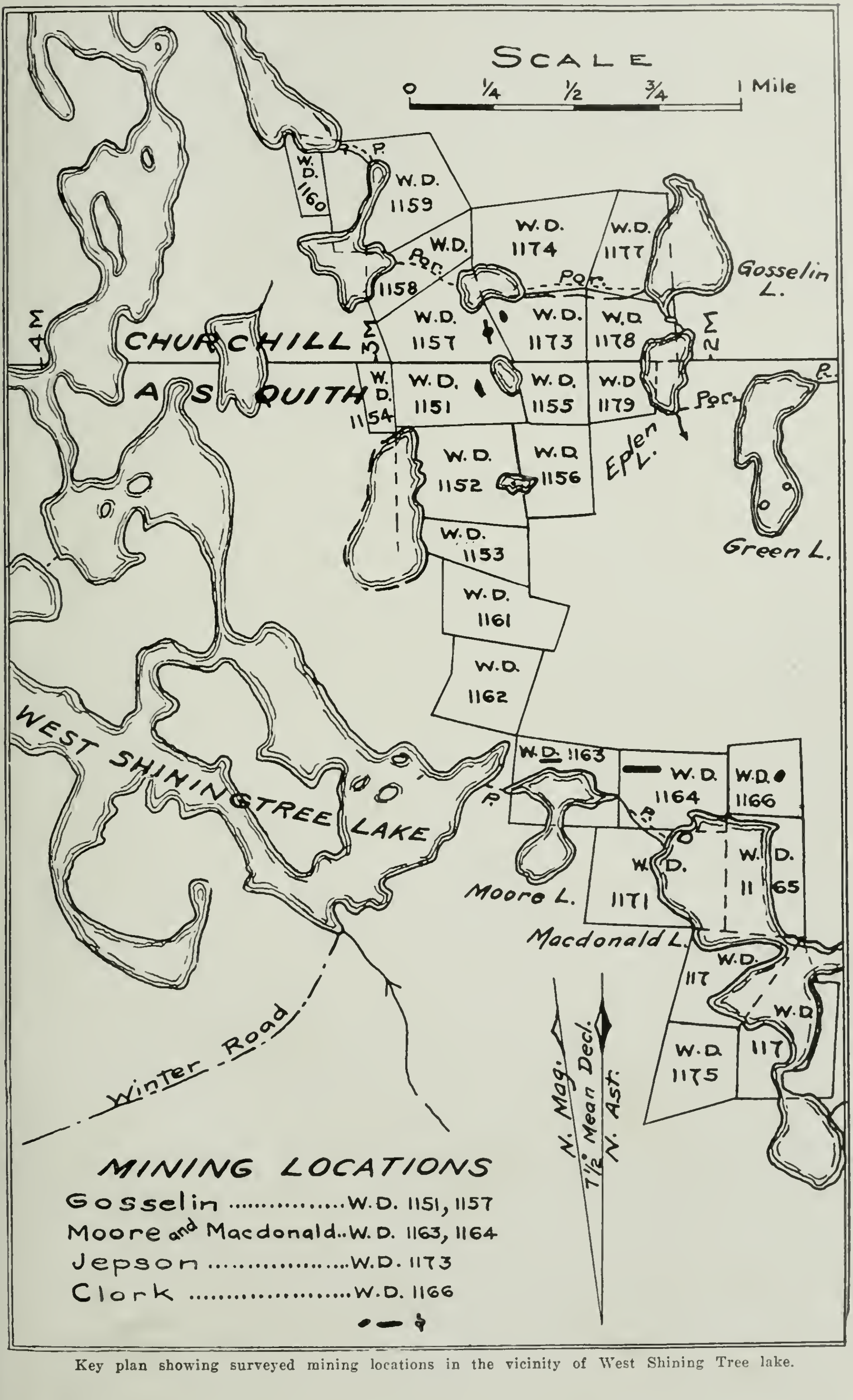
[1] Bur. Min. Vol. X. (1901), p. 151.

[2] Bur. Min. Vol. X. (1901). p. 151.



Key plan showing surveyed mining locations in the vicinity of West Shining Tree lake.

quantity, as the weathering of the carbonate-bearing rocks forms a great deal of rusty material. These rocks vary in colour from dark to light green and effervesce with acid. Good examples can be found on W.D. 1166, north of MacDonald lake. This association of carbonates with Keewatin rocks occurs in many places in northern Ontario. Mr. Burrows describes similar rocks at Porcupine in his report[3] on that district, and also quotes from various writers who have observed them in other localities.

The greenstones of the region vary greatly in appearance, but it is very difficult to work out definite relations. The rock on the portage between MacDonald and Stewart lakes was taken as typical of the area around West Shining Tree lake and eastward to the Montreal river. It is a rather soft rock of grayish green colour. A section under the microscope shows that it consists largely of fibrous hornblende, chlorite and saussurite, with an indistinct ophitic texture.

The relation of the felsite, porphyry, and syenite, referred to above, with the other rocks was not worked out, but they are probably of a later age. All the outcrops of these rocks that were found occur just east of West Shining Tree lake.

A good example of the felsite can be found on the shore of West Shining Tree lake at the end of the portage to Firth lake. It is very fine grained and light coloured, and weathers white under the moss. It consists of quartz and feldspar, some of the latter shewing albite twinning lamellae. Considerable sericite is present.

A small outcrop of granite porphyry occurs on the west side of W.D. 1163. In consists of quartz, feldspar and sericite. A few micrographic intergrowths of quartz and feldspar surround some of the larger phenocrysts of quartz and feldspar. The rock has been crushed in some parts.

On the north side of the portage from Speed to Gosselin lakes an outcrop of syenite occurs that extends several chains. It consists dominantly of feldspar, part of it showing albite twinning lamellae. The quartz is subordinate. A similar rock can be found on the south side of W.D. 1156, five chains from the No. 3 post.

Quartz porphyry occurs in several places. An outcrop running in a northeasterly direction is to be found crossing the eastern side of W.D. 1159, a few chains north of the southeast corner. Distinct phenocrysts of quartz and feldspar show on the weathered surface. These are contained in a fine grained ground mass.

Diabase

Dikes of fresh looking diabase cut the older rocks in several places in the district. A fresh looking quartz-diabase occurs at the south end of the small lake just east of West Shining Tree lake on the boundary between Asquith and Churchill.

An outcrop of iron formation is to be found at the fire rangers' cabin on the west side of Michikawakenda lake. An impure reddish iron ore is interbanded with a slaty rock. These bands are narrow and appear on the horizontal surface. They have been thrown into angular and rounded folds. Farther to the south greywacke slates are found in a vertical position.

The occurrence of the iron formation in this territory was reported by Mr. Burrows[4] who observed it near the north end of Shining Tree lake in 1896. At a later date Dr. Coleman[5] examined the geological relationship of the iron formation in the same area.

Mining Claims

Many of the claims have been located on the east and west shear zones which often contain numerous stringers and small veins of quartz, some of which carry visible gold. A great deal of rusty decomposed material is found in these zones, due to the weathering of the pyrite and carbonates that occur in the schist. Gold, in a state of fine division, can be panned from this rusty material in some places. This gold has probably been associated with the pyrites, as a quantity of pyrite crystals picked from the rock on one property, showed on assay a small quantity of gold. Several of the larger veins seem to be associated with the more massive rock, but even these are accompanied with considerable rusty schistose material.

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[3] Bur. Min. Vol. XX. (1911).

[4] Bur. Min. Vol. VI. (1896), p. 167.

[5] Bur. Min. Vol. X. (1901), p.181.

The claims in two localities were attracting attention at the time the writer was in the district, namely those situated immediately east of West Shining Tree lake, and those in the southwest of the township of MacMurchy, near where the outlet of Michikawakenda lake enters the expansion of the Montreal river. The general character of the country rock appeared to be similar in the two localities, but the area immediately east of West Shining Tree lake contains felsites and porphyr'es that were not observed in the vicinity of the claims located near the Montreal river. The rocks of the latter locality are probably more massive than those farther to the west.

At the time the writer was in the field very little work had been done on any of the properties, so that it was impossible to get very definite information regarding the extent and nature of the deposits.

Gosselin Claims

This property comprises several claims on either side of the boundary between Asquith and Churchill, just east of the 3-mile post. On the northeast corner of W.D. 1151, stripping revealed several masses of quartz containing visible gold. The quartz showed continuously in places for 30 or 40 feet and was 10 to 18 feet wide. It is associated with a felsitic rock that weathers white on the surface. This rock extends east three or four chains to the shore of a small lake. Here quartz stringers cut the felsite in a very irregular fashion and, in places, constitute about one-half of the rock. In other places near the lake this rock is free from quartz and has a schistose structure.

On W.D. 1157, about three chains north of the township boundary, near the east side of the chain, an extensive outcrop of quartz occurs. Stripping showed the quartz at intervals for six or seven chains running in a northwesterly direction. Where the most stripping had been done the quartz was exposed continuously for 2 chains, running northwest, and about 10 feet wide. From the south end of this showing, a trench running west exposed quartz with some schist for seventy feet. Gold was seen in the quartz about 10 chains from the township boundary and close to the east line of the claim. Just east from here on W.D. 1173 several irregular quartz masses have been stripped. The largest one is about 45 feet in length and averages about 12 feet wide .

The felsite found on W.D. 1151 extends northward into W.D. 1157 for about three chains and contains some quartz, but most of the quartz on the latter claim is contained in a much decomposed greenstone, schistose in places and weathering very rusty.

These claims have the most extensive bodies of quartz so far found in the district and have attracted considerable attention. Gold was first discovered in the district on this property.

The Clark Claims

These claims are situated north of MacDonald lake. On the one examined (W.D. 1166) a mass of quartz and carbonate rock rises about 15 feet above the surrounding level. The outcrop has been stripped along its north and east sides for about four chains. The carbonate rocks occurring here vary in colour from dark to light green and contain a great many crystals of iron pyrites. Judging from the great quantity of rust found here siderite must be the predominating carbonate. The darker coloured rock has a schistose structure. A thin section under the microscope shows it to be composed largely of carbonate with another mineral having the optical properties of sericite. In this section the lighter coloured rock is seen to consist almost wholly of carbonate with a little quartz and sericite. It is said that gold can be panned from the rusty material that occurs abundantly on the property.

A ridge, of a granite-like rock three chains wide, crosses the north boundary of this claim about seven chains from the northeast corner. This rock resembles that found on the portage between Speed and Gosselin lakes, which has proven to be a syenite.

Moore and MacDonald Claims

These claims (W.D. 1163 and 1164) are situated north of Moore lake. On W.D. 1164 a zone of decomposed rusty schist with quartz stringers can be traced for nine chains running east and west. Its width is over 50 feet. The schist contains considerable pyrite and carbonate material. The quartz veins are 10 inches wide in places, but the total quartz would make up only a small part of the sheared zone.

On W.D. 1163 a similar zone with white quartz stringers has been located for several chains. This may be a continuation of the mineralized zone in W.D. 1161 What is apparently the same lead has been located on the claim west of W.D. 1163.

Gold has been reported to occur in the schists on these properties.

The Cryderman Claim

This claim (2331) lies southwest of the Moore and MacDonald claims on the shore of West Shining Tree lake. On the property a zone of very rusty decomposed schist 70 to 80 feet wide has been stripped for 150 feet. Bluish quartz stringers are associated with the schists, which contain a great deal of iron pyrites. The decomposed material gives on panning considerable finely divided gold.

The Jefferson Claim

This claim (2504) is located in the southwest part of MacMurchy where the outlet of Michikawakenda lake enters the expansion of the Montreal river. A quartz vein striking in an easterly and westerly direction and dipping to the north runs up the side of the shore which is 50 or 60 feet high at this place. The vein is three or four feet wide and can be traced for about two chains, but pinches out in two places in this distance. A good deal of rusty schist with small quartz stringers lies alongside the main outcrop. The surrounding rock is more massive than on many of the claims. The quartz is white with a good deal of iron rust formed from the oxidation of the pyrite. Free gold was found about the centre of the outcrop, occurring in fine particles, well distributed throughout the quartz.

Seville Claim

This claim (2536) is west of Jefferson's. The outcrop consists of several irregular masses of quartz associated with a rusty schist containing many quartz stringers. These quartz masses are five feet wide in places, and seem to extend in a westerly direction, but are not exposed for more than forty feet. No free gold was found on this property, although the quartz and surrounding rocks appeared to be almost identical to those found on the Jefferson property. The rocks on this claim are in the main massive, but a pronounced schistose structure is developed in places. A section of the schist from this claim shows it to consist of calcite or dolomite, chlorite, sericite and clear grains of quartz and feldspar. It may be termed a green calcareous schist.

Caswell Claims

These claims (2532 and 2542) are located just above the portage between Michikawakenda lake and the Montreal river. On 2532 there is a zone of rusty schist striking a little north of east. This had been stripped fifteen feet across for a distance of over 30 feet. Many quartz stringers occur which follow the strike of the schist. Free gold was seen in the largest of the quartz stringers.

On the claim 2542 another zone of weathered schist with quartz stringers occurs. Its general direction is a little north of east. This zone is over 20 feet across and the quartz shows in places from one to two feet wide.

McIntyre Claim

This claim is southeast of Jefferson's a short distance. No work had been done on the property. The quartz in one place was apparently about 20 feet wide, but did not maintain this width far. Smaller outcrops can be traced west from the main one for four chains. The surrounding rock is shattered, but not very schistose. A thin section shows it to be a fine grained greenstone of basic composition, consisting of hornblende, plagioclase, leucoxene, chlorite and quartz. A vague ophitic texture would seem to relate it to the diabases.

Conclusion

The geological features of the West Shining Tree district resemble those of the Porcupine gold area. Keewatin rocks, massive and schistose, predominate in both districts, and it is in these rocks that veins and irregular masses of quartz carrying gold are found. The carbonate rocks occurring in the Porcupine area have their equivalents in the West Shining Tree district, and felsites or rhyolites and porphyries are common to the two areas

Gold is widely distributed in the quartz of the district, but in most places the quantity is small. Gold was observed on four properties, and assays of seven samples of quartz taken from as many claims showed no gold in one and values ranging from 40 cents to $6.00 to a ton in others. Two of the samples that came from properties where the quartz was several feet in width assayed $1.60 and $2.80 to the ton. Development work may, of course, bring to light richer ore bodies.

A great many of the quartz veins that have been located are small and irregular, and the large quantity of rock that will necessarily be removed with the quartz in mining operations, will lower the grade of the ore. The occurrence of one apparently extensive body of quartz with visible gold in several places, and the general distribution of gold in the district are encouraging features, and seem to indicate that the small amount of systematic prospecting and development work that has been done so far is not proportionate to the possibilities of the area.

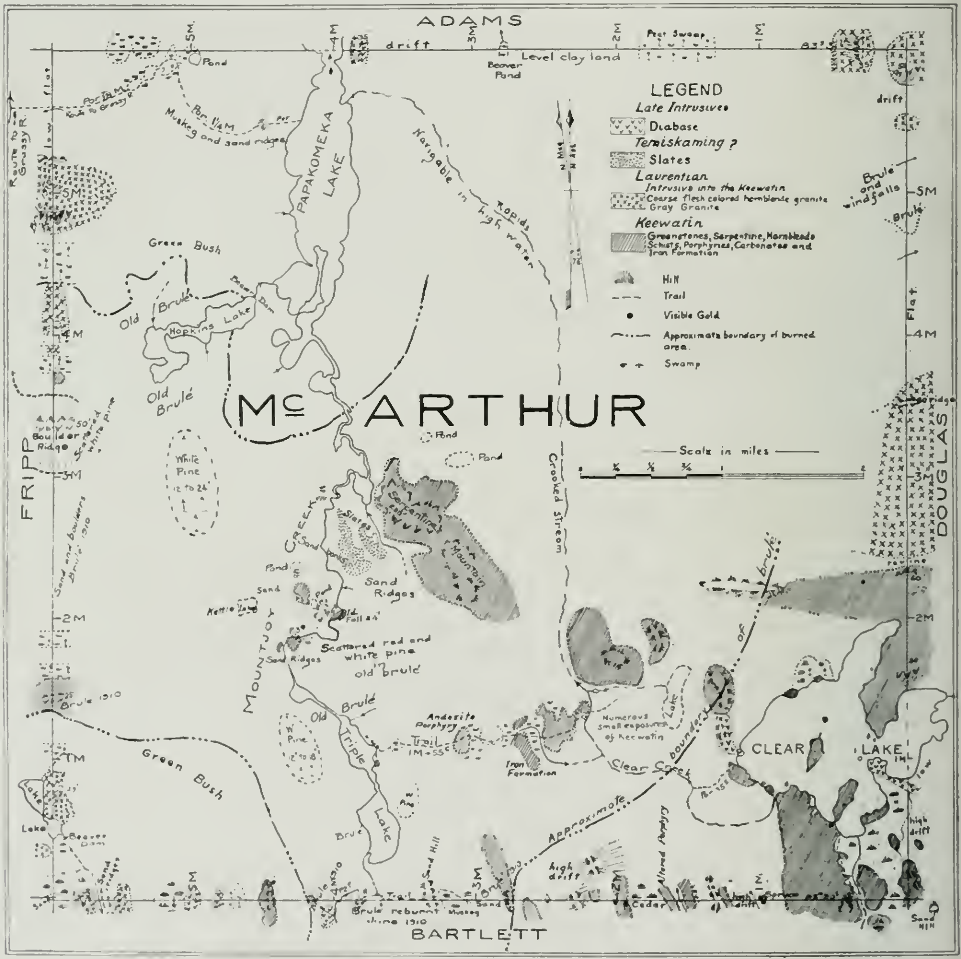
Two maps accompany this report. The large one includes the West Shining Tree district and territory adjacent on the south and west in order to show the canoe route from Gowganda Junction, and also to give the location of the Canadian Northern railway. All the surveyed mining claims of which information is available are shown on the map. The small map shows the location of the surveyed claims east of West Shining Tree lake.

In closing, the writer wishes to express his thanks to Mr. C. W. Knight who made the microscopic examination of the rock sections, and to Mr. W. R. Rogers for the preparation of the maps.

NOTES ON McARTHUR TOWNSHIP

By P. E. Hopkins

McArthur lies three townships south of Tisdale in the Porcupine gold area. It can be reached by trail directly south from South Porcupine following the township boundaries; or by canoe up the Mountjoy river via Mattagami Landing. The latter route was opened in August, 1911, by the prospectors and used for bringing in their supplies. Much cutting of logs and clearing of log jams was required in order to make the river navigable, but it will be necessary to repeat the work another season.



Map of McArthur township, showing geology.

The topography of McArthur is one of low relief, broken by low hills and ridges from 25 to 60 feet high. The most striking feature is the serpentine hill about the centre of the township rising to a height of 230 feet above Mountjoy river, which lies at the foot on the western escarpment. Adams township, immediately to the north, is comparatively level or slightly rolling in character, consisting mostly of sand, with its forest completely destroyed by fire.

Claims were staked for gold in the southeast part of McArthur in the spring of 1911, but little work other than trenching had been done in October, 1911, when the area was examined The classification of the rocks is shown in the legend of the map.

Geology

The oldest series, the Keewatin, outcrops very extensively in the southeast quarter of the township. The rocks consist dominantly of hornblende schists, which in many places are altered to serpentine. In the centre of the township is a high ridge of serpentine with an elevation of 230 feet, which shows glacial striae 40 degrees east of north. Other Keewatin rocks are greenstones, iron formation, porphyries, and carbonate rocks filled with a network of intersecting quartz veinlets. The largest body of iron formation is on the trail about one mile east of Triple Lake, and consists of banded silica and magnetite, some bands of which are an inch in width. The quartz-feldspar-porphyry between the first and second mile post on the south boundary is fine-grained, brownish in colour, greatly altered, and may be called a granophyre. About one-half mile east of Triple lake is an adesite-porphyry. In this section the groundmass shows small phenocrysts of andesine and quartz in a fine groundmass of quartz, chlorite, feldspar, sericite, and calcite. A flow structure is well indicated in the section. It is possible that porphyry and other pebbles were picked up during the flow, giving it a conglomeratic appearance. Some of the diabase may be of Keewatin age.

An expansion of Mountjoy river, showing a hill of serpentine, 230 feet high, in McArthur township.

The Laurentian, which occurs in a series of ridges about 30 feet above the surrounding country in the north half of the township, is a coarse flesh-coloured, hornblende granite. In the southwest there are many exposures of gray biotite granite.

The Temiskaming series, which occurs as a small belt in the centre of the township consists of fine slates and schists with a vertical dip and strike N. 10 degrees to 50 degrees W.

Diabase intrusives, varying from a few feet to 300 feet in width, other basic intrusives, and quartz-feldspar-porphyry dikes cut the Keewatin and Temiskaming series.

Economic

Gold

The gold-bearing rocks of McArthur belong to the Keewatin series. In these rocks occur quartz veins and porphyry dikes, both of which were reported to carry gold.

Gold was observed by the writer only in the quartz veinlets which intersect the seven-foot quartz-feldspar-porphyry dike on the Chouinard property, south side of Clear lake This vertical dike, which strikes 50 degrees east of north, outcrops in a steep face of serpentine on the lake shore; and grab samples taken gave low gold values. Several porphyry dikes, which may be offshoots from a granite mass, occur in this area. On the same property is a dome-like mass of quartz 150 feet long and 60 feet wide, a few samples from which gave only traces of gold. Closely associated with the large mass of quartz are dikes of porphyry which may be of later origin than the quartz, but the relatioship was not clear on account of so much drift.

At the two-mile post on the south line of McArthur in Bartlett township is the Hull claim, on which much visible gold was said to occur in a very narrow quartz vein in a fine grained felsitic rock which is in contact with hornblende schist a few chains to the west.

Agriculture, Forest and Water Resources

There are some level tracts of clay in McArthur and Adams capable of davelopment for agricultural purposes, but for the most part the soil is sandy. The township of Adams has been denuded of practically all forest growth by the fires of 1910 and 1911. However, some banksian and white pine, birch and spruce, still remain in McArthur in areas shown on map. The pine is from 1 to 2 feet in diameter, but the stands are small in area.

In Adams are three falls with drops of 28, 25, and 17 feet respectively, and one in centre McArthur with a fall of 24 feet, all of which are on the Mountjoy river.

Mr. W. R. Rogers made the surveys of lakes and streams shown on the map which forms part of the text of this report.

Mr. J. G. McMillan examined the geology of the country contiguous to the township of McArthur in connection with the T. and N. O. railway trial lines between Porcupine and Gowganda. A map showing the area accompanies his report which has been published by the Temiskaming and Northern Ontario Railway Commission.

GEOLOGY OF THE DETROIT RIVER AREA

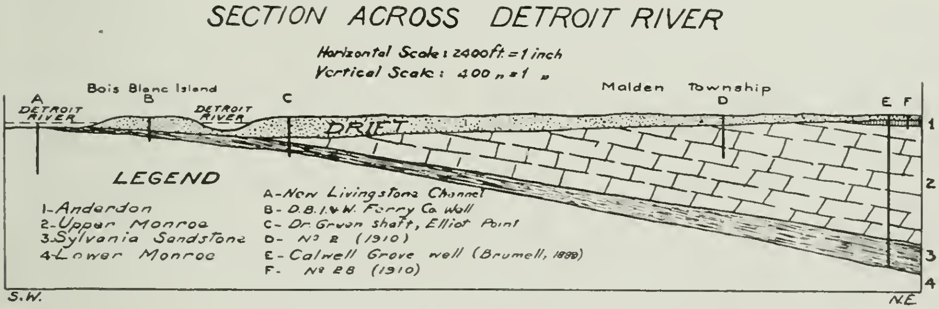
By Rev. Thomas Nattress, Amherstburg

Rev. Mr. Nattress, of Amherstburg, who has given considerable attention to the geology of the Detroit river area, has supplied geological cross-sections which are published with this volume, and the following notes to accompany the same:—

Anderdon Limestone Beds

In both the Amherstburg, Ont., and the Sibley, Mich., quarries, immediately associated with the Corniferous deposits and below them, are beds of limestone high in calcium carbonate, named in 1907 by Amadeus W. Grabau, who examined the rock at the instance of the State Geologist of Michigan, the Anderdon limestone beds. Up to that time the formation had not been recognized.

Forty drill cores, taken out to determine the extent of the deposit of Anderdon limestone in Anderdon and Malden townships, have disclosed a basin and a trough leading to it from the south, together containing the Anderdon beds. I have named this trough the Malden valley of Anderdon limestone, and have followed it up some 6,500 feet from a point in Malden township to where it expands into a basin, the central area of which is the Amherstburg quarry property.[1] The basin approximates 4,000 feet in diameter.


SECTION ACROSS DETROIT RIVER
Horizontal Scale: 2400 ft. = 1 inch
Vertical Scale: 400 „ = 1 „
Bois Blanc Island
Malden Township
A
B
C
D
E
F
DETROIT RIVER
DETROIT RIVER
DRIFT
1
2
3
4
LEGEND
1-Anderdon
2-Upper Monroe
3-Sylvania Sandstone
4-Lower Monroe
A-New Livingstone Channel
B-D.B.I.&W. Ferry Co. Well
C-Dr. Green shaft, Elliot Point
D-Nº 2 (1910)
E-Calwell Grove well (Brumell, 1888)
F-Nº 28 (1910)
S.W.
N.E.

NOTE.—The section is a general one through Malden township, Essex county; Bois Blanc Island; and Detroit river. It is compiled from information derived from wells approximately in the line of section.

At the immediate base of the Anderdon is a rock of transitional character with a percentage of calcium carbonate from 60.56 to 69.04. The average percentage over a distance of two miles is 63.49. This transitional rock therefore contains a higher percentage of calcium carbonate than does the heavy-bedded dolomitic limestone which lies second above it and forms the base of the Corniferous.[2] This dolomitic rock contains about sixty per cent. of $CaCo_3$. Like it, the transitional rock appears to be almost fossil free.

Age of the Beds

Prof. Grabau has emphasized the Devonian affinities of these beds, while classifying them as Silurian. I have shown that these beds do not lie between two dolomites; that they rest upon a transitional dolomitic limestone which is Devonian in its chief characteristics; and that they are Devonian in chemical properties, containing as high as 99.55 per cent. of calcium carbonate; and whereas Grabau describes "the Monroe beds and underlying formation (as) all involved in slight folding which took place in post-Monroe and pre-Dundee times," I have shown the Anderdon limestone beds occupying the synclinal space between two of these lateral folds. It would appear that the Anderdon limestone beds have been wrongly classified as Silurian, and that they are really of Devonian age.

---

[1] 13th Report Mich. Ac. Science, 1911.

[2] Corniferous—Dundee (Michigan)—Jeffersonville (Indiana)—Columbus (Ohio)—Onondaga (New York.)

Trenton-Sibley Area

Twenty-five drill holes were put down in the Trenton-Sibley area in the season of 1911, 20 of which penetrated the Anderdon beds; the other five were outside the limestone deposits and south of them.

In this area Anderdon material occurs in the same form as at the Amherstburg quarry, in basin formation. Its relation to strata above and below is the same as on the Canadian side of the river. Immediately below the Anderdon is a dolomitic limestone resting upon dolomite and outcropping beyond the outer edge of the Anderdon. Immediately overlying the Anderdon is the Corniferous (Dundee) with dolomitic limestone base, the Anderdon outcropping beyond the outer edge of this deposit.

Other Occurrences of Anderdon Limestone

Other occurrences of Anderdon limestone rock of the same quality and varied appearance as that of Essex and Wayne counties, are found along the Maitland river at Goderich; along Lake Huron north of Goderich, in the neighborhood of Kincardine and Southampton; at Cargill and at St. Marys, following along the north side of an arm of the old Devonian sea; and in the Thames valley between Ingersoll and Woodstock. It has also been identified immediately to the westward of the Columbus (Corniferous) outcrop on Marble Head, Ohio.

The small Canadian islands in the western end of Lake Erie show only dolomites and no trace of the Anderdon. If the Anderdon beds outcrop in Lake Erie, it will be along a line west of Pelee and Kelly's island, and east of Put-in-Bay island, Bass islands

Cross-Sections of the Detroit River

Amherstburg to Sibley

A cross-section of this area, from Amherstburg quarry on the Ontario side to the Sibley quarry on the Michigan side and including both of these, shows Anderdon and overlying Corniferous at each end of the section, with only the underlying domolites over the intervening distance. The depth of the boulder clay and other features are also shown. The direction of the cross-section is N. 57° W.; the distance 35,700 feet; the eastern end of the section 10,200 feet east of the east channel bank of the Detroit river, and the western end 6,000 feet west of the west channel bank.

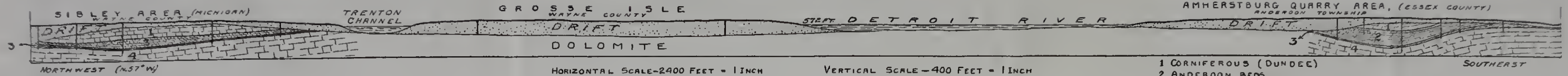
The section shows that the beds occur in the form of gentle synclines at the Sibley and Amherstburg areas. But the vertical scale is six times the horizontal, so that these synclines are greatly exaggerated on the cross-section. As a matter of fact, if the section were drawn with the vertical and horizontal scales equal, the undulations or folds of the strata would be hardly noticeable.

Malden to Bois Blanc Island

At a point west of the south quarter of Bois Blanc island and in the new Livingstone channel there was found to be a light deposit of Sylvania sand resting upon bedrock. This sand was scraped off by the dredges in clearing the bottom preparatory to drilling. There was no sand rock penetrated by the drills, only dolomite being found here. The Detroit, Belle Isle and Windsor Ferry Company's wells show a surface extension of Sylvania over the south quarter of Bois Blanc. Dredging in the river channel east of the island showed a Sylvania surface extending over the immediately adjacent river bottom. Two farms lie adjacent eastward. On one of these, the Patton, under forty feet of drift and one foot of shale, there is a 20-foot depth of Sylvania, described as consisting of 10 feet of loose white sand and 10 feet of sand rock. Below this 20-foot deposit the drill penetrated dolomite. South of this on the next farm in the Dr.

SECTION ACROSS THE DETROIT RIVER

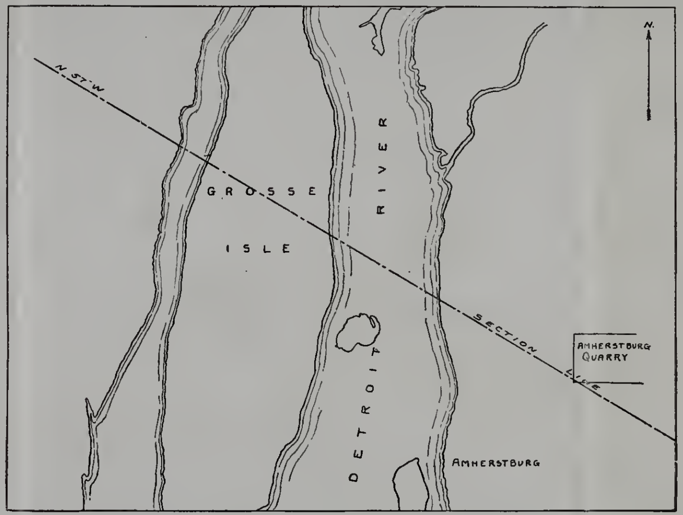
To accompany Report by Thomas Nattress in Part I of
The twenty first Report of The Bureau of Mines
—ONTARIO—
Hon. W. H. Hearst, Minister of Lands, Forests and Mines
Willet G Miller, Provincial Geologist
1912



HORIZONTAL SCALE—2400 FEET = 1 INCH VERTICAL SCALE—400 FEET = 1 INCH

NOTE: *The vertical scale is six times the horizontal, thus greatly exaggerating the gentle synclines at both ends of the section.*

1 CORNIFEROUS (DUNDEE)
2 ANDERDON BEDS
3 DOLOMITIC LIMESTONE
4 DOLOMITE



MAP SHOWING POSITION OF SECTION

SCALE
0 1 2 MILES

Green shaft, at Elliott's Point, the drill was put down into the Sylvania some distance, under 44 feet of drift, blue clay and a gravel bed next the rock, and 25 feet of dolomite. Some 7,500 feet northeasterly from this is the Colwell Grove well,[3] the record of which shows 252 feet of limestone next above 60 feet of sandstone. The well was drilled in 1889, up to which time no distinction had been made in the records between limestone and domolite. In the immediate neighborhood of the Colwell Grove well is the number 28 well of my survey of 1910. This shows about four feet of Anderdon limestone under 12 feet of drift. Below the Anderdon 9 feet of transitional limestone rests upon dolomite. Neighbouring tests, wells Nos. 29, 27, 30, and 1 of the 1910 survey show similar deposits of Anderdon.

The Dry Cut Channel

Mr. Nattress also contributes the following notes on the geology of the "Dry Cut" part of new Livingstone channel now under construction by the U.S. Government in the Detroit river:—

Steam shovel in rockwork, also fast working drill invented for this contract.

Situation of the Cut.

The new Livingstone channel under construction by the United States Government, in Detroit river, reaches from Ballard's reef, north of the Lime Kiln crossing, out into Lake Erie about two miles beyond the Detroit river light house. From end to end it is thirteen miles in length. The purpose of it is to relieve the congestion of lake traffic by providing a channel for down-bound boats (the new one) and one for up-bound traffic. The work of construction has been contracted for in sections, of which the Stoney Island "Dry Cut" is one.

It has been called the "Dry Cut" for the reason that an area 5,750 feet in length has been enclosed within an earthen dam, unwatered, and the channel excavated in the dry. This was the method employed by the same contractors, Grant Smith and Company and Locher, in the construction of the new West Neebish channel of the Sault river.

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[3] Geo. Sur. Canada. Vol. V., 1889, part Q.

The rock cut constituting the new channel in this distance is 450 feet wide; the amount of rock removed 1,400,000 cubic yards, or over 3,000,000 tons; and the earth removed, over the south quarter of the distance, 160,000 cubic yards.

The Rock Formations Exposed.

It has been claimed by some of the American geologists that the rock over this area is Upper Monroe, or the uppermost Silurian—as hitherto recognized in southern Michigan and western Ohio. This is, however, questioned by such authorities as Professor Charles Schuchert, of Yale and Dr. Stauffer, of the Western Reserve University at Cleveland. The writer has also presented evidence, as published in the Michigan Academy of Science report of 1911, that it cannot be of later age than the Lower Monroe; and that the anticlinal formation is, along with Grosse Isle, the northern extension of the great Cincinnati anticline

The strata penetrated within the cut have been measured by Professor W. H. Sherzer, of the State Normal College, at Ypsilanti, for the Government of Michigan, along with myself, and found to total 102 feet in the distance of 5,750 feet The fossil-bearing strata are but few in proportion to the entire depth and number of strata cut through. The forms contained are, with the exception of *stromatopora*, but moulds and casts.

Retaining wall at top of channel cut and in front of west dump, showing cap stratum of Stony Island anticline.

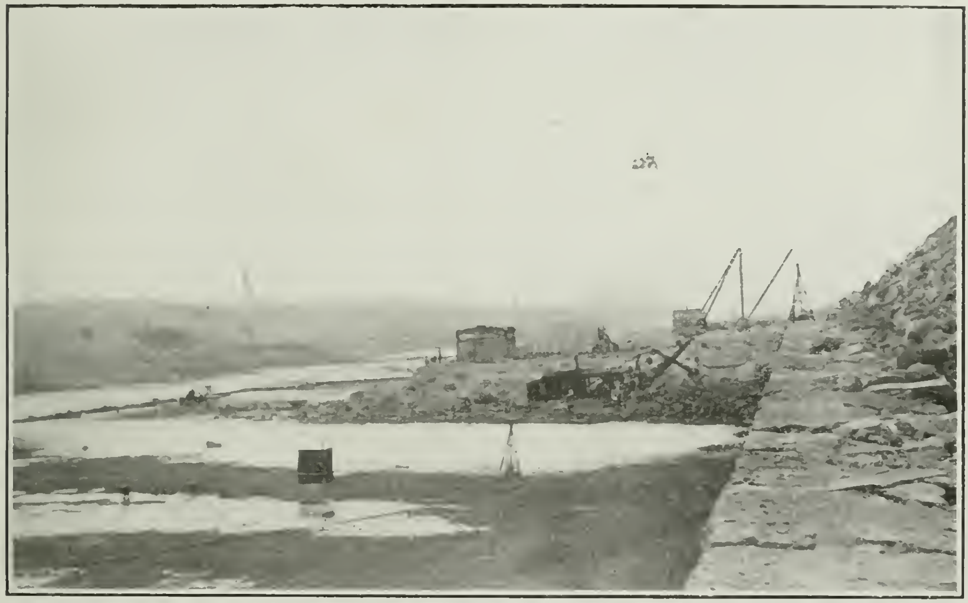
The division of the strata into faunal zones suggested by one student of the deposit is too general in character and not sufficiently exclusive; (1) the Coral Zone—the lower strata at the north end; (2) the Zone of *Cladopora bifurcata*—the middle beds; and (3) the Zone of Smaller Gasteropods.

The lower strata, (including the cap-stratum of the Stoney Island anticline, the first stratum below this, which is the lowest penetrated in the Cut; the bed above the cap-stratum, carrying but few forms; and the next above that, making four strata altogether;) are characterized by branching corals, spreading corals, and cup-corals, and may very properly be characterized as The Coral Zone. These beds carry also in abundance *Conocardium* and *Schuchertella;* also *Cyrtoceras*, *Dawsonoceras*, and *Loxonema* (the larger forms) coming in.

Cladopora bifurcata will be found too general in its distribution throughout the series to be impartially considered as marking a faunal zone.

The second zone (or middle zone of three) is characterized by *Panenka Canadenis;* a certain smooth surfaced, rare-occurring *Orthoceras;* the larger gasteropods, and the *Prosserellas*— which latter continue on up through the strata. The smaller gasteropods are also coming in.

The third faunal zone is very well described as the zone of smaller gasteropods. There are, however, three several horizons of smaller gasteropods; the lowest associated with the larger gasteropods; the second (or middle,) 8 to 14 inches in thickness of deposit, is crowded with these forms; and the third, or upper, 4 to 5 inches in thickness. The *Prosserella* continues. So also does *Cladopora bifurcata,* in ill-preserved condition toward the south end of the cut. *Clathrodictyon ostiolatum* is an outstanding feature of this zone. There also occurs the flattened imprint of something that suggests *Cyrtoceras.*



Stony island "Dry Cut"—a general view taken from the north showing one of the three steam shovels at work with dump skip lowered alongside

Physical Features of the Deposits

The deposits that have been thought to be sand are impregnated with strontianite in minute crystals that have, for the most part, dissolved out. I do not suspect silica. There does not seem to have been either an in-shore or an immediately off-shore influence at work in the depositing of rock material hereabout. A probable explanation of the heavy-bedded and largely non-fossiliferous strata in the Silurian rock penetrated in the cut is rapid deposit of rock material in deeper water whereas the fossil-crowded interbedded strata mark periods of comparative uplift and shoal water, and of slow deposit of rock material.

The crystals that characterize the strata penetrated within the "Dry Cut" are sulphate and carbonate of strontia, scalenohedra of calcite, calcite seams of minute dog-tooth crystals, and—in cavities within nodules and in hollowed cores of *Clathrodictyon ostiolatum*—minute quartz crystals.

There are shales, thin, and usually—though not always—more or less bituminous, at some half dozen horizons; and considerable thin-lined, apparently open sea, and very shallow sea deposits.

Ripple marks, varying in characteristics, were noted at several horizons, and at two in particular which suggest the varying influence of the lapping sea. It is just possible that the apparently—though only apparently—concretionary deposits at two horizons are explainable by reference to wave action, very gentle, uniform, and of long continuance without appreciable variation.

Toward the south end of the "Dry Cut" the anticlinal formation falls away to the synclinal, which, of shallow depth, extends along the west side of Bois Blanc island almost to its foot where another anticlinal south-to-north billow is developed.

Very heavy erosion has taken place along the east side of the cut toward the south end, and a correspondingly deep deposit of boulder till left. This is now thought to be Illinoisan till. On the opposite side of the cut the glacial striæ are well defined and do suggest, in direction, the Illinoisan movement.

All of the original contract width of cut, 300 feet, is, at the north end, in Canadian water. So also is nearly, if not quite, the entire length of the dry cut on its east side. The west side of the completed 450-foot cut is probably altogether in United States water. The new channel will be lighted by pairs of permanent light-houses throughout the whole length of deep rock cuts, and most of these lights on the east side of the channel will be in our waters.

Cross section of earthen dam between upper and central parts of unwatered area, showing the main conduit conveying air from compressor plant.

Islands in West End of Lake Erie

The following notes on the geology of the smaller Canadian inlands in the west end of Lake Erie are likewise by Mr. Nattress:—The smaller Canadian islands in the west end of Lake Erie have not hitherto been reported upon geologically and though charted, are scarcely recognized as Canadian territory. The geological map of Ontario suggests by proximity that they may be Devonian and Corniferous. The geological map of Michigan suggests that they might be of the age of the uppermost Silurian dolomites. The Ohio map suggests with almost a certainty that they must be Lower Monroe, and that they may be Clinton or Niagaran.

Amid this uncertainty, and on the lookout for the high-grade limestone beds to which Professor Grabau has given the name of the Anderdon Beds, I chartered a tug on 31st July and made the tour of these islands.

North Harbor and East Sister Islands

On North Harbor island, some twelve miles off shore from the mainland of Essex county, there is a heavily glaciated surface of about an acre in extent of very compact dolomite. A preglacial uplift had left the island—as is true of all the islands in the west end of Lake Erie—exposed to the onset of the ice sheet, which, in passing off the bluff west side, caused the rock to break and fall off to westward.

East Sister island lies less than a mile south of North Harbor and is fifty to seventy-five acres in extent. The rock is the same here as on North Harbor. Ripple marks were observed.

Old Hen and Chickens

Old Hen island with its associated reef, the higher points of which are called "The Chickens," lies some four miles to the southeast of East Sister. The same strata are exposed here, and beds below these. The uplift at this point has been greater than in the case of North Harbor and East Sister, and seems to have been of the nature of a thrust since every side is bluff, except where the southeast side has been cut down by glaciation. Wave action has done considerable undermining of the heavy upper beds on the more exposed sides of this island. Some thirty feet in depth of rock is exposed. A Cleveland fishing club has a club house and cottages on this small piece of land. Samples of rock were taken which, on analysis, show $CaCo_3$ 55.60, 56.10, 55.90, 55.10, 55.70, 55.60, and 54.90.

Middle Sister

Middle Sister island is the most westerly of the Canadian islands in Lake Erie. It is about eight miles in a northwesterly direction from East Sister island. The rock elevation here is about the same as on Old Hen island, perhaps slightly greater. The same wave erosion was observed here as on the latter island.

The rock on all four of these islands resembles closely the Monroe of the Bass islands and Put-in-Bay island to the south, in Ohio waters. It is probably the Lower Monroe formation.

Banks of water-worn pebbles, free of sand, are piled up on the exposed beaches of these islands, sometimes bank on bank. The rock itself, being a dolomite, would make a good road metal, and would be readily accessible for break-water purposes or filling for crib-work.

As for the Anderdon Beds, if these outcrop at all in Lake Erie it will be between Pelee Island and Old Hen island. The distance across is about six miles, giving ample room for these beds where, in the order of nature, they belong—between the base of the Corniferous and the top of the Monroe.

The outer end of Marble Head, and Kelly's island, Ohio; Middle or Lighthouse island (the most southerly point in Canada) Pelee island, and a point on the mainshore of Essex county just outside the mouth of Detroit river and below Bar Point,—these are all Devonian and Corniferous, (the Columbus of Ohio geological reports, the Dundee of Michigan,: or the Onondaga of New York). All west of that quarter circle, and in Lake Erie, including West Sister island is Silurian.

End of Part I.

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MAP
OF THE
SWASTIKA GOLD AREA
DISTRICT OF TEMISKAMING
ONTARIO

To accompany Report by E. L. Bruce *in the Twenty-First Report of the Bureau of Mines, 1912.*

Hon. W. H. Hearst, *Minister of Lands, Forests and Mines.* Willet G. Miller, *Provincial Geologist.*

Scale: $\frac{1}{31,680}$ = 40 Chains to an Inch

MINING LOCATIONS

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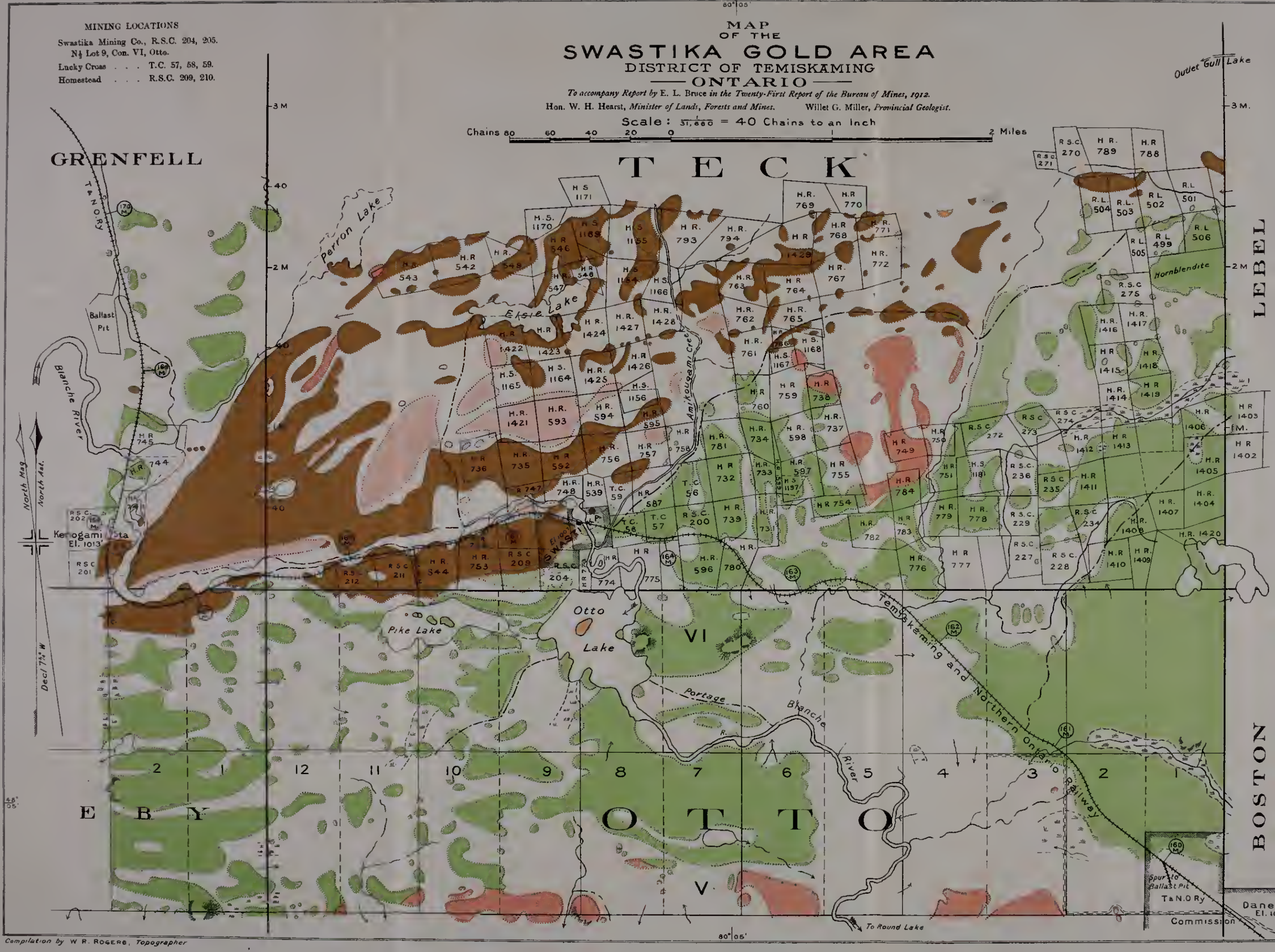


NOTES

Keewatin.—The oldest rocks of the Swastika area are greenstones. In places these rocks are altered to schists or are serpentinized. They sometimes, however, show their original basaltic texture, and an ellipsoidal structure is occasionally seen. Associated with the greenstones and schists are a few bands of iron formation and also a well-banded epidote rock.

On the north side of the Keewatin belt the strike of the schists averages N.E., and the dip 70° N.W. Farther south the schists are lying flat. On the south side the strike is W. 64° E. and the dip is 80° S.E.

Cutting the greenstones and schists is a grey feldspar porphyry consisting of feldspar phenocrysts in a groundmass of quartz, feldspar and sometimes hornblende. Occasionally the hornblende is lacking, and the rock consists entirely of quartz and albite. An area of hornblendite also occurs. This rock is composed of large phenocrysts of hornblende in a fine grained basic groundmass. It is intrusive into the Keewatin schists and greenstones.

Laurentian.—The Laurentian of the area is made up chiefly of syenitic rocks. These are often very coarse grained with feldspar crystals up to an inch in diameter. The hornblendite mentioned previously may be a basic segregation from the syenite magma.

Huronian.—The Huronian consists of conglomerate and greywacké. The pebbles are greenstone and porphyry with an occasional piece of granite. A striking feature is the large number of fragments of jasper often of considerable size. Albite very similar to that of the grey feldspar-porphyry is found in the greywacké. Near the Keewatin the Huronian is squeezed and altered, a band of carbonate rock often separating typical Huronian from typical Keewatin. This alteration may possibly be due to post-Huronian faulting. In parts of the area, the relation of the rocks classed as Laurentian to the Huronian is doubtful. In other parts conglomerate overlies the syenite and includes pebbles of it. There may therefore be two series of Huronian rocks, viz., one older than the syenite and the other younger.

Post-Huronian.—Two series of dikes are clearly intrusive into the conglomerate and greywacké. One of these is a red granitoid rock consisting largely of a high soda feldspar. It cuts the Huronian, sending out tongues into the sedimentary rock.

The other post-Huronian intrusive is basic in character. It consists of phenocrysts of augite in a groundmass of augite and feldspar needles. It shows in places a pseudo-amygdaloidal texture and weathers with a pitted surface.

These two dike rocks were not found in contact with each other.

Diabase.—The Keewatin is cut by numerous dikes of diabase, some of which may be post-Huronian. Many of them, however, are considerably altered. and none were found cutting conglomerate or greywacké.

LEGEND

GLACIAL AND RECENT

☐ *Drift.*

DIABASE

🟧 *Dikes of diabase intrude the Keewatin. These may be post-Huronian or older.*

POST-HURONIAN

☐ *Augite lamprophyre, red and dark-grey porphyry.*

HURONIAN SYSTEM

🟫 *Conglomerate and greywacké. Two series of conglomerate, Temiskaming and Cobalt, may be included in the Huronian, though no unconformity was seen.*

LAURENTIAN SYSTEM

🟥 *Syenite and other acid rocks. Part may intrude the Huronian.*

KEEWATIN SYSTEM

🟩 *Greenstone, basalt and iron formation.*

🟩 *Grey feldspar-porphyry.*

- - - - *Trail.*

— — — *Road.*

Hill.

Swamp.

NOTES

Elevations of lakes above sea level were taken from C. N. O. Ry. plans.

The canoe route from Ruel station to West Shiningtree lake was improved during the winter of 1911-12 by the construction of two dams on the Opickinimika river. These are situated in the townships of Miramichi and Garibaldi, and their position is indicated on the map.

Compass lines showing timber berth boundaries in the township of Shelly are shown in approximate position.

SIGNS

Height of Land.
Por Por. *Portage.*
Hill.
C.N.O.Ry. constructed.
Winter Road.
R *Rapid.*
1289' *Elevation above Sea Level*

MAP
OF THE
WEST SHININGTREE AREA
DISTRICT OF SUDBURY
SHOWING ROUTE FROM CANADIAN NORTHERN ONTARIO RAILWAY

TO ACCOMPANY REPORT OF R. B. STEWART IN THE TWENTY FIRST REPORT
OF THE BUREAU OF MINES, ONTARIO, 1912.

HON. W. H. HEARST, *Minister of Lands, Forests and Mines.*
WILLET G. MILLER, *Provincial Geologist.*

SCALE : $\frac{1}{126{,}720}$ or 2 Miles = 1 Inch.
1 ½ 0 2 4 Miles.

MINING LOCATIONS

A. Gosselin ..	*W. D. 1151, 1157*
Moore & McDonald....	*W. D. 1163, 1164*
Clark. .	*W. D. 1166*
S. Jepson.	*W. D. 1173*
G. Bennett .	*W. D. 1196*

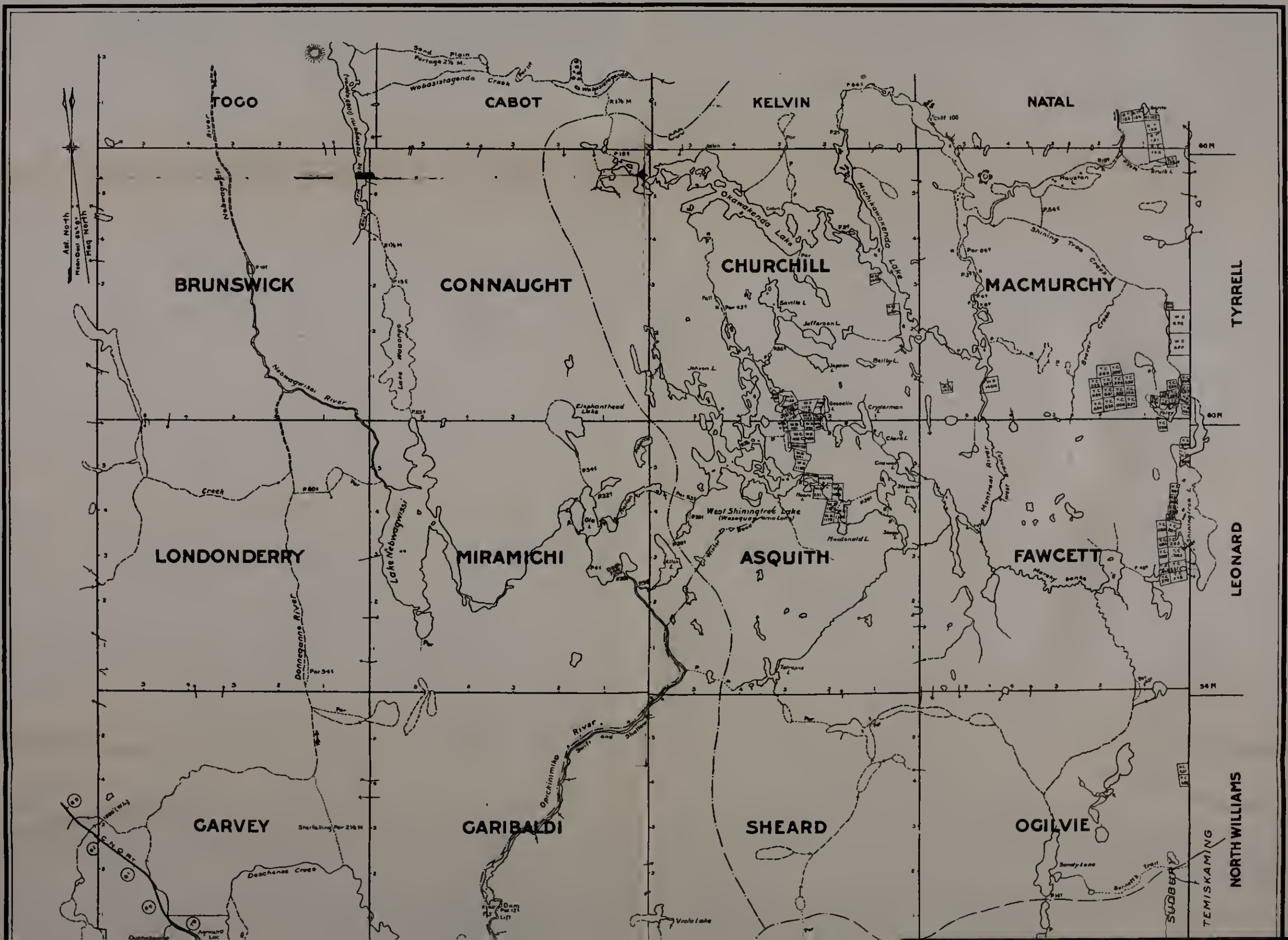
SOURCES OF INFORMATION

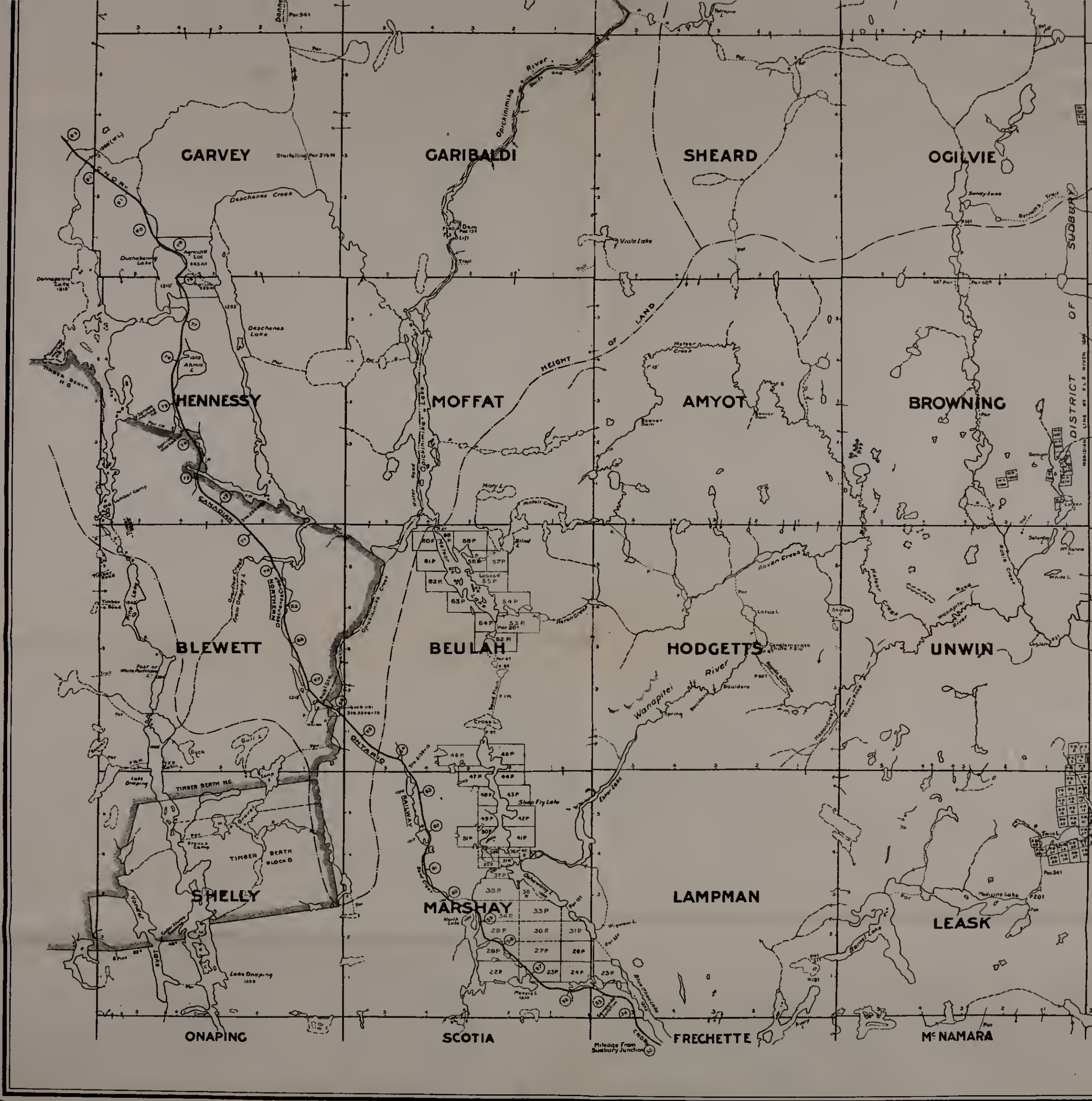
Township outlines from Department of Lands, Forests and Mines, Surveys Branch.

Canadian Northern Ontario Railway Surveys.

Traverses of Okawakenda and Michikawakenda lakes and Opickinimika river by W. R. ROGERS.

Advance photographic map of West Shiningtree, also traverses except as above noted by W. H. Collins, Geological Survey of Canada.




GARVEY
GARIBALDI
SHEARD
OGILVIE
NORTH WILLIAMS
HENNESSY
MOFFAT
AMYOT
BROWNING
DUFFERIN
BLEWETT
BEULAH
HODGETTS
UNWIN
STULL
SHELLY
MARSHAY
LAMPMAN
LEASK
VALIN
ONAPING
SCOTIA
FRECHETTE
McNAMARA
HEIGHT OF LAND
DISTRICT OF SUDBURY
DISTRICT OF TEMISKAMING
CANADIAN NORTHERN ONTARIO RAILWAY
C.N.O.R.
Opickinimika River
Deschenes Creek
Deschenes Lake
Duchabenny Lake
Ahmic L.
Viola Lake
Wanapitei River
Raven Creek
Misty L.
Lake Onaping
Welcome Lake
Medicine Lake
Shoo Fly Lake
TIMBER BERTH BLOCK B
TIMBER BERTH H.C.
Mileage from Sudbury Junction

Map N° 21d

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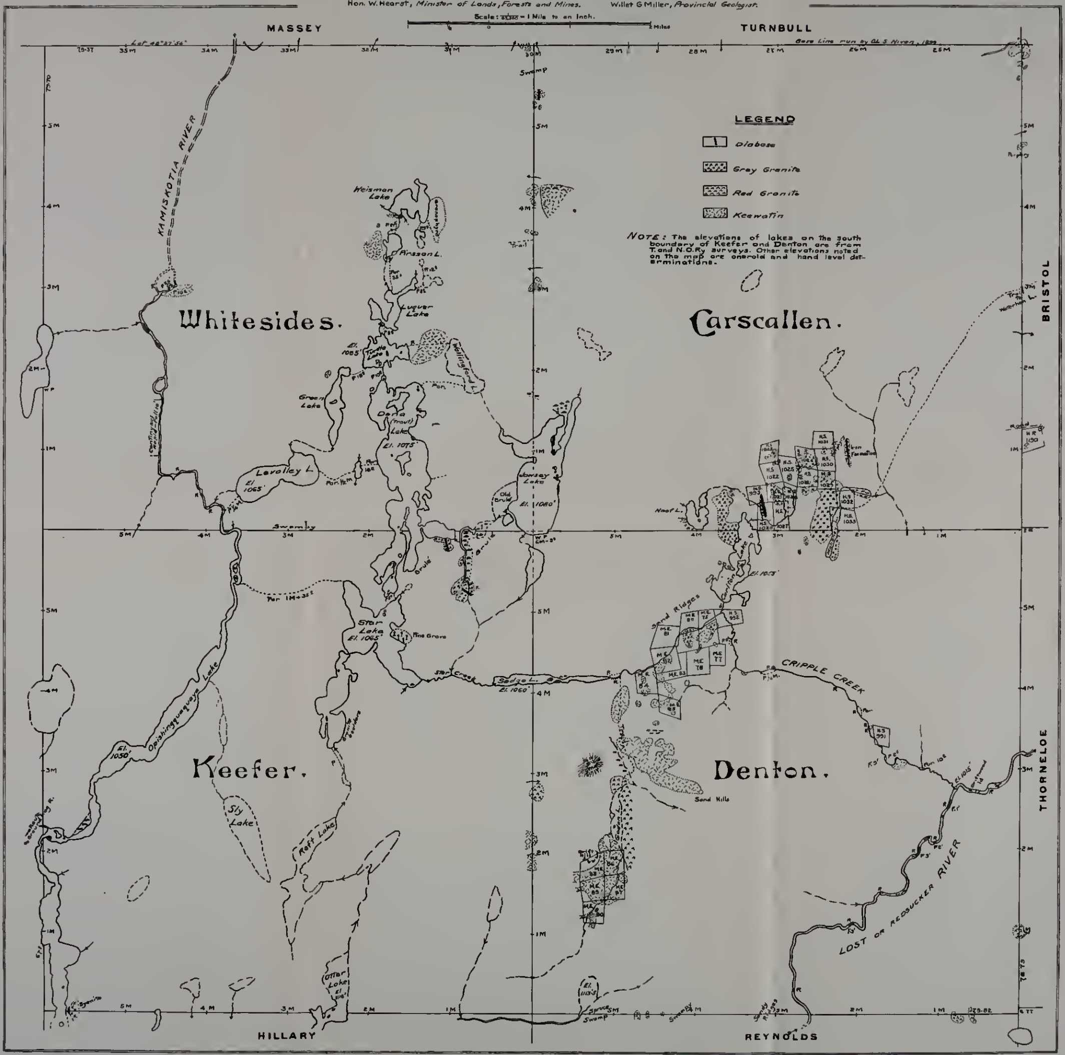
GEOLOGICAL SKETCH MAP OF THE CRIPPLE CREEK AREA
DISTRICT OF TEMISKAMING

To accompany Report by W R Rogers and E. L. Bruce in the Twenty First Report of the Bureau of Mines, 1912.

Hon. W. Hearst, *Minister of Lands, Forests and Mines.* Willet G Miller, *Provincial Geologist.*



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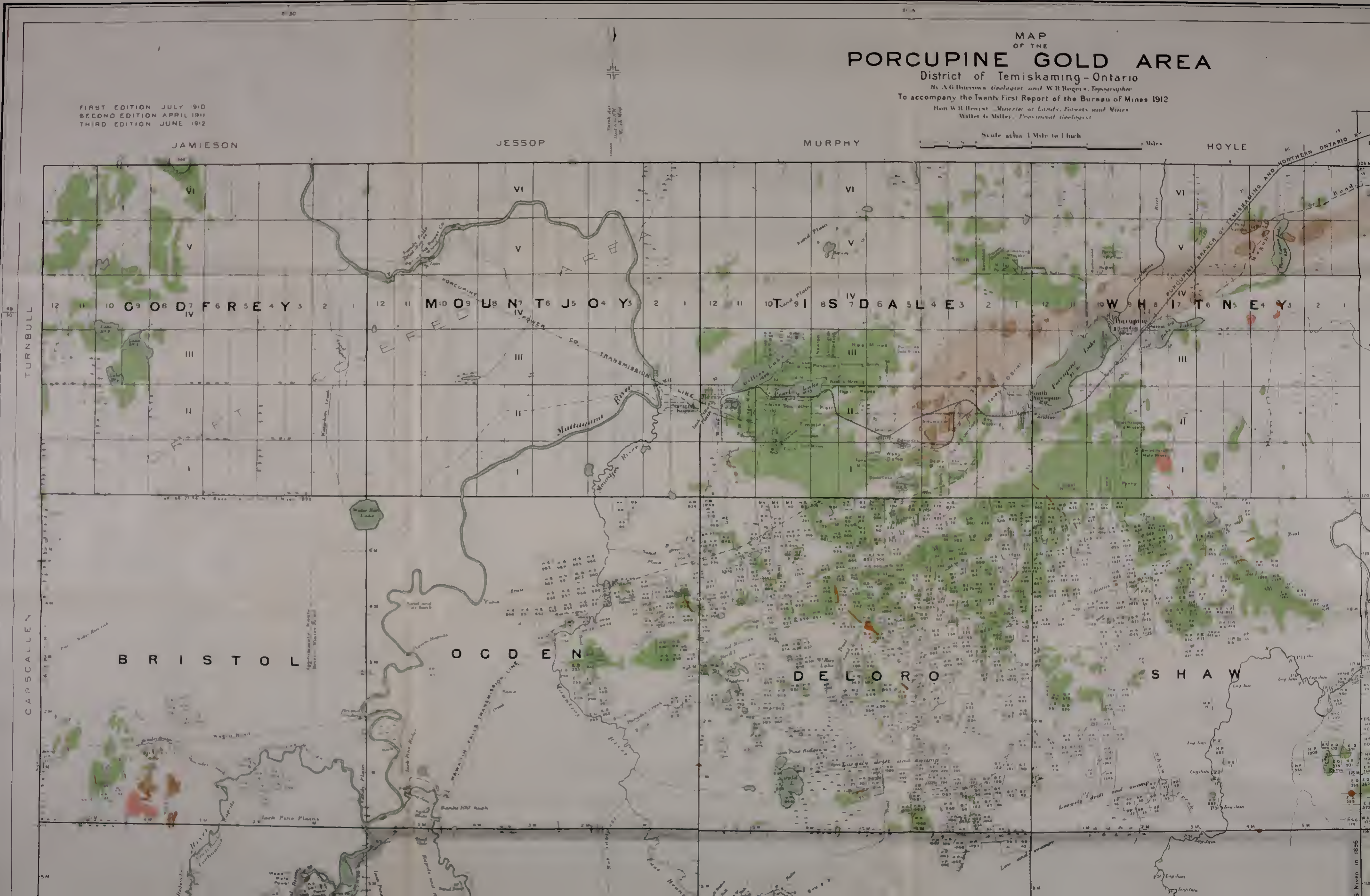
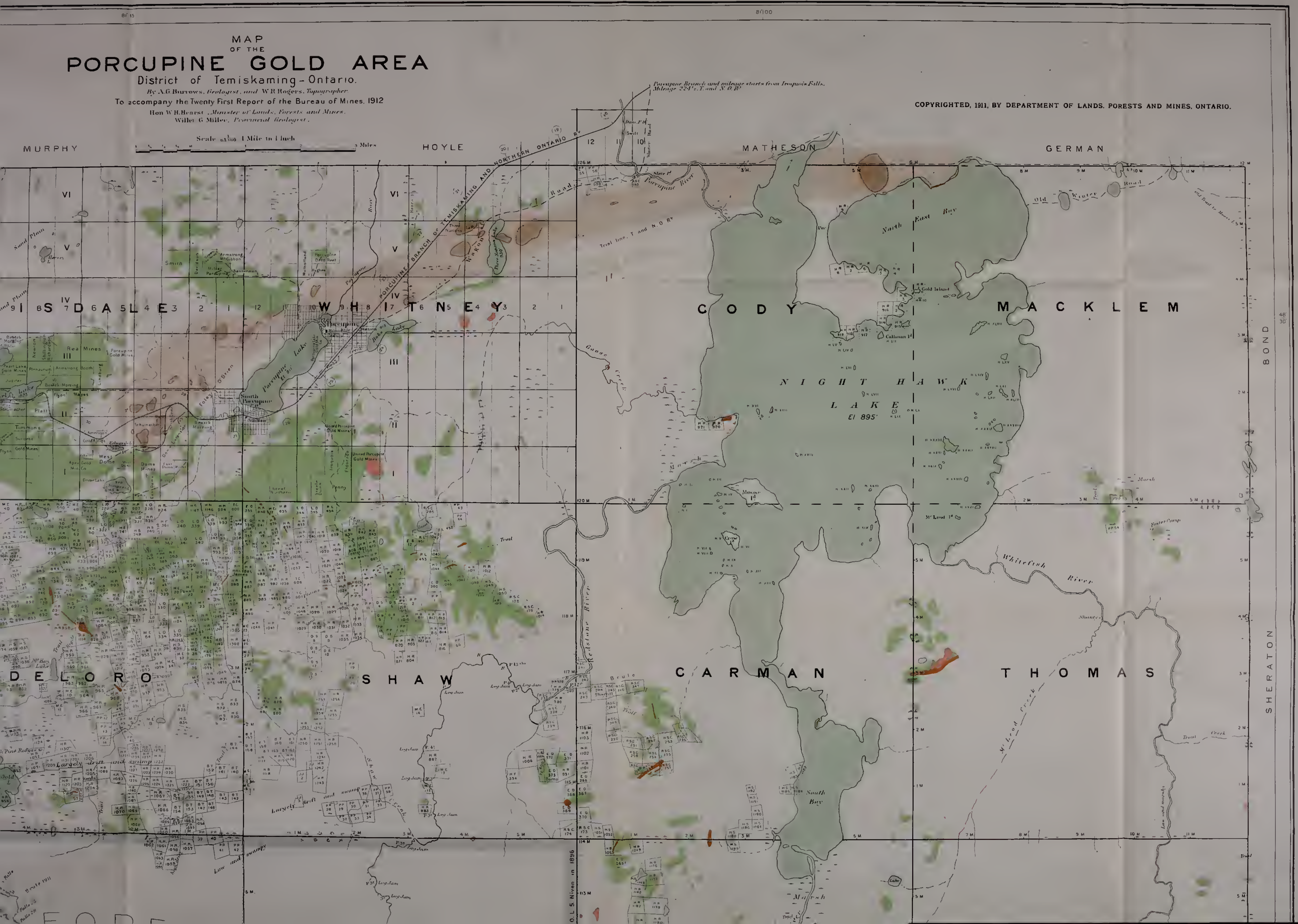


MAP
OF THE
PORCUPINE GOLD AREA
District of Temiskaming - Ontario
By A. G. Burrows, Geologist and W. R. Rogers, Topographer
To accompany the Twenty First Report of the Bureau of Mines 1912
Hon. W. H. Hearst, Minister of Lands, Forests and Mines
Willet G. Miller, Provincial Geologist

FIRST EDITION JULY 1910
SECOND EDITION APRIL 1911
THIRD EDITION JUNE 1912

Scale about 1 Mile to 1 Inch



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Scale $\frac{1}{63360}$ 1 Mile to 1 Inch

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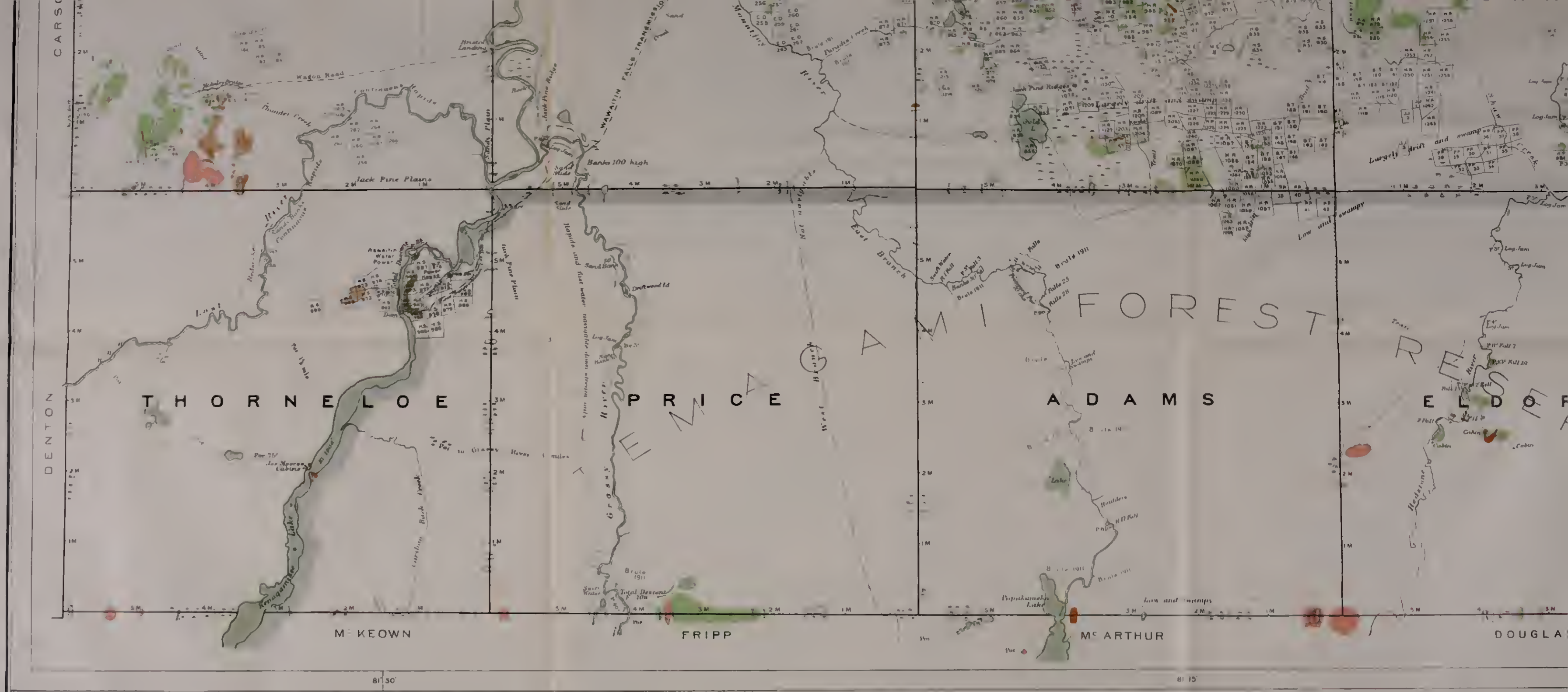
Porcupine Branch and mileage starts from Iroquois Falls. Mileage 224½, T. and N. O. Ry



NOTES

By A. G. BURROWS

TWO editions of this map have been published, the first being based on field work during May and June, 1910. The second edition was the result of a more extended examination during the remainder of the season of 1910. During 1911 further field work was done and mining locations which were not surveyed the previous year were mapped. In addition several other areas beyond the confines of this map were examined. These included the Munro and Guibord gold area, the Swastika area; an area to the southwest of Porcupine, including Denton, Carscallen, Whitesides and Keefer, and the township of McArthur directly south of Porcupine. Geological maps of these areas, together with the third edition of the Porcupine map, have been prepared and accompany the Bureau of Mines Report, Volume 21.

In the unsubdivided townships mining location surveys have been utilized in mapping geological boundaries. Several of these surveys have been made since the field work was finished, and in consequence it may be found that the geological boundaries do not conform properly to some recently surveyed lines. However, it is believed that most of the rock outcrops immediately around Porcupine have been shown.

HISTORY OF DISCOVERIES

Until the last two or three years the Porcupine area was difficult of access and little prospecting was done in it. The information concerning it was practically all contained in the reports published by the geologists who accompanied O. L. S. Niven in his base-line work and the township surveyors in the years 1896, 1898, 1899, 1903, 1904 and 1905. In 1896, Mr E. M Burwash accompanied Mr Niven as geologist in the survey of the Nipissing Algoma boundary line, which, it may be added, now forms the boundary between the districts of Nipissing and Sudbury. The boundary was run northward to mile 120, which is now situated at the southeast corner of the township of Whitney, and the eastern boundary of the township of Shaw includes that part of the line lying between mile 114 and mile 120. Mr Burwash's description is published in Volume 6 of the Report of the Bureau of Mines. He points out that the district gives promise as a gold-field. The following extracts are taken from his report, pages 180, 181 and 183: "Near the 118th mile the line finally passes off the granite and intrudes upon grey slate rocks. On the first half of the 116th mile (now on the eastern boundary of the township of Shaw) a small quartz vein occurs which, on assay, was found to contain a trace of gold . . . . The district would be a promising one from the prospector's point of view were it not for the presence of the drift . . . . In the lower parts of the series (Keewatin), on the other hand, gold appears to be quite widely distributed, both in veins which are of tolerably frequent occurrence and in mineralized portions of the rock itself . . . . In two cases the veins were situated near the boundary of granite areas. In two localities, between the 85th and 95th miles, the gold occurs in mineralized bands of the country rock, which in both cases is more or less chloritic."

In 1898 Mr. W. A. Parks reported on the geology of the district for the Bureau of Mines. His paper is published in Volume 8. Mr Parks noted the occurrence of gold in traces in some of the quartz veins, and said — "I regard the region south of the trail to Porcupine lake as giving promise of reward to the prospector. Interesting reports on the district including or adjacent to Porcupine were later made for the Bureau of Mines by Mr Geo F Kay, Mr. James G. McMillan and Mr H L. Kerr, whose reports are published in Volumes 13, 14 and 15 respectively of the Bureau of Mines.

The first prospecting in the area appears to have been done in 1906, when a shallow pit was sunk on a claim adjacent to what is now known as the Hollinger mine. The next work in the area was done by Mr. H F. Hunter on the northeastern shore of Porcupine lake. The vein uncovered here shows gold in hand specimens. In 1909, interest was revived in the district by the discoveries of Mr. J. S Wilson and others. Mr James Bartlett, one of the Bureau's geologists, made a brief examination of the discoveries in October, and a report by him was shortly afterwards made public.

ROUTE TO PORCUPINE

During 1911 the Ontario Government constructed a branch railway into Porcupine. This line leaves the main line of the Temiskaming and Northern Ontario railway at Mileage 222½, now known as Iroquois Falls. This branch line has been gradually extended to Timmins townsite, which will be the terminus for some time, being at the western edge of the main gold mining area. The distance from Toronto to Timmins by rail is 485 miles.

TOPOGRAPHY

Much of the surface of the area is low and wet, although it can scarcely be said to be swampy. The lower flat surface is occupied by well-banded clay, together with some sand and gravel. Overlying the clay is a layer of vegetable mould from a few inches to a foot or more in thickness. This layer holds water, the underlying clay being impervious, and presents a surface somewhat difficult to drain. Outcrops of compact rock occur irregularly over the surface covering. Since some of them are small, they are difficult to locate. In some sections of the area the rocks rise into ridges which extend across parts of several lots. In most cases their height above the general level is not more than 50 feet. Occasionally it is 100 to 150 feet.

The area lying between the mouth of Porcupine river and Porcupine lake has a maximum elevation of about 970 feet. The southwestern part of Tisdale is considerably higher, the hill behind the Hollinger clubhouse, for instance, reaching an elevation of 1157 feet above sea level.

In the area embraced by the map the greatest relief is about 535 feet. This difference in elevation occurs between the Mattagami River and a prominent hill 2½ miles distant on the north boundary of the township of Godfrey.

The lakes are shallow, Night Hawk lake having a depth of only 5 feet in many parts. The greatest depth of water found in Porcupine lake was 20 feet.

GEOLOGY

The legend of the map gives the age groups of the rocks which have been recognized in the field.

Keewatin.—The oldest series, the Keewatin, is similar in character to rocks of this age found in various parts of northern Ontario, from the Quebec boundary on the east to that of Manitoba on the west. It consists of various volcanic rocks with their schistose representatives. The series is here much more disturbed, as is illustrated by the schistose character in many places, than it is in the Cobalt area. In the Porcupine area, however, some of the Keewatin rocks have escaped dynamic metamorphic agencies sufficient to show their original character. In parts of the township of Whitney and elsewhere, for instance, certain basalts still retain quite perfectly their amygdaloidal texture and ellipsoidal structure. Most of the Keewatin in the Porcupine area, as elsewhere, consists of dark coloured or greenish, massive or schistose rocks of basic or intermediate composition. Quartz-porphyry is, however, a rather common rock in the Porcupine area. While it occurs characteristically in dikes, cutting green schists, it is also found in larger masses. Certain quartz porphyry dikes have been subjected to pressure and broken up, and now resemble conglomerate. The metamorphic action has produced a dark greenish base through which are set fragments of the porphyry. Probably volcanic fragmental rocks of Keewatin age occur in the area, but they have not been definitely recognized.

Associated with the Keewatin, especially in the southern part of the township of Whitney, there is much iron formation. This iron formation is what is commonly called jaspilyte, and consists of alternate thin bands of magnetite and silica, the latter being frequently red in colour. Many of the Keewatin rocks contain considerable carbonate—calcite, dolomite or a ferruginous carbonate. In some parts of the area are masses of rocks essentially composed of these minerals, giving rise to crystalline limestone which is usually rusty-weathering. Such an occurrence is found on the northern part of lot 10 in the sixth concession of Whitney township. This outcrop covers an area of 12 to 15 acres and is not seen in contact with other rocks. It may correspond in age to the crystalline limestone of the Grenville series of eastern Ontario. In the vicinity of the Dome mine there is an outcrop of a ferruginous carbonate. It would appear not unlikely that carbonate in some places is a replacement mineral, and that a considerable volume of rock may at times have been replaced by the carbonate. A ferruginous

LEGEND

GLACIAL AND RECENT

☐ *The uncoloured areas are largely drift covered, and consist of boulder clay, stratified clay, sand, etc.*

Pre-Cambrian

LATER INTRUSIVES

🟥 *Quartz-diabase, olivine diabase, and other later dikes.*

IGNEOUS CONTACT

COBALT SERIES

🟫 *Conglomerate*

UNCONFORMITY

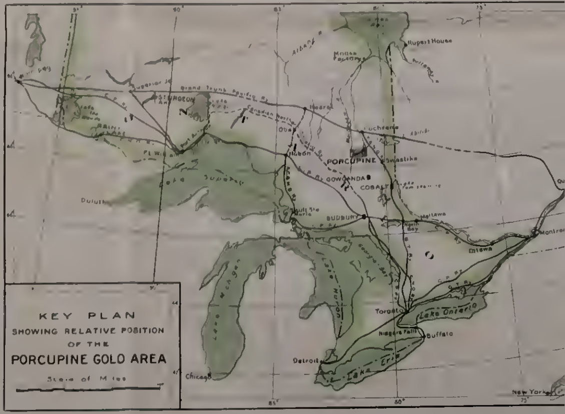
TEMISKAMING SERIES

▨ *Conglomerate, quartzite, greywacke, slate or delicately banded greywacke*

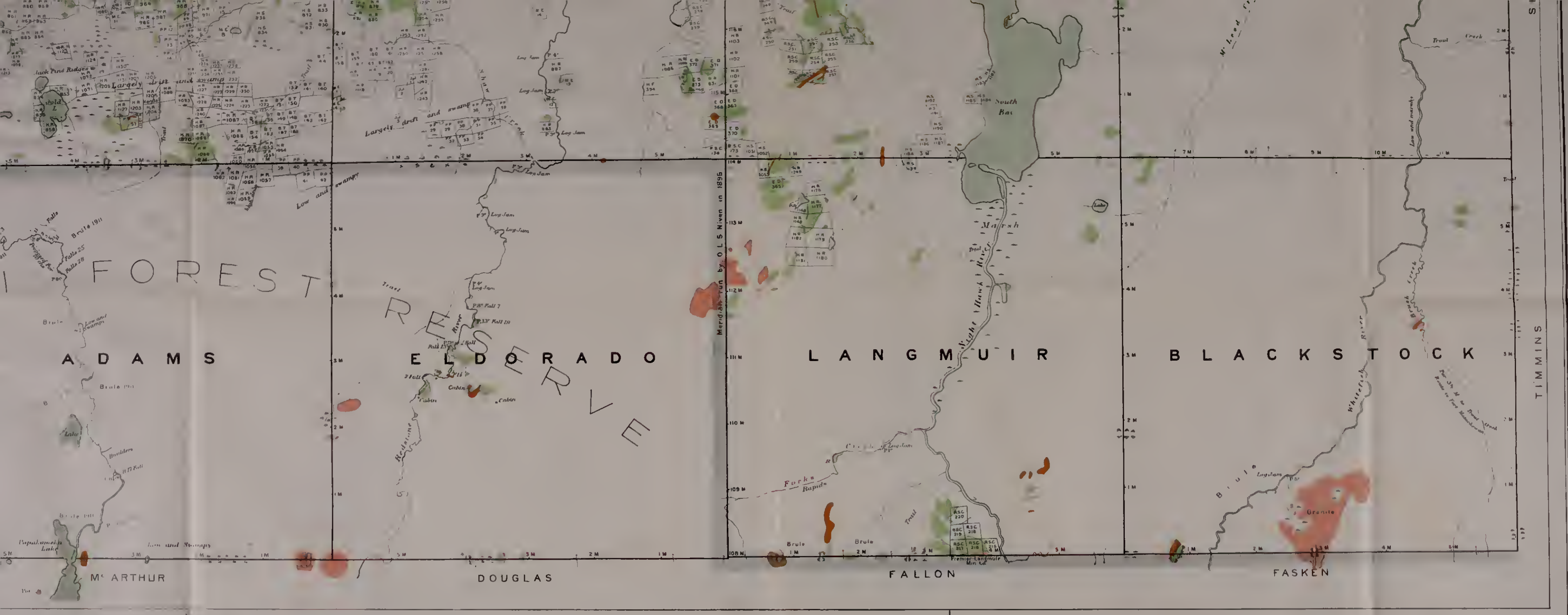
UNCONFORMITY

LAURENTIAN SYSTEM

🟥 *A complex of granites older than the Cobalt series. It intrudes the Keewatin, but its relationship to the Temiskaming is not definitely known, it may be in part older and in part younger than the Temiskaming series.*



KEY PLAN
SHOWING RELATIVE POSITION
OF THE
PORCUPINE GOLD AREA



N D
NT
areas are largely
consist of boulder
, sand, etc.

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olivine diabase,
es.

TACT

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ES
quartzite, grey-
delicately banded

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anites older than
It intrudes the
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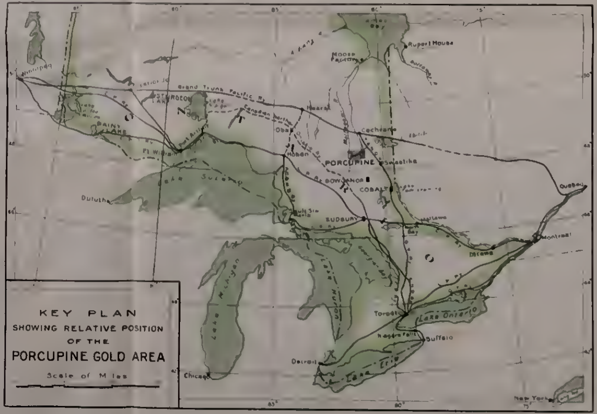

KEY PLAN
SHOWING RELATIVE POSITION
OF THE
PORCUPINE GOLD AREA
Scale of Miles

LEGEND—(*Continued*)

IGNEOUS CONTACT

KEEWATIN SYSTEM

🟩 *The series consists chiefly of basic to acid volcanic rocks, much decomposed, and generally schistose. Sediments are uncommon. Amygdaloidal basalt, serpentine, diabase, quartz or feldspar-porphyry, banded iron formation, and rusty weathering carbonate rocks have been recognized.*

SIGNS

⁂	*Swamp.*
F.	*Fall.*
P or Por.	*Portage.*
R	*Rapid.*
⌒	*Hill.*
....	*Trail.*
—	*Road.*
911'	*Elevation above Sea Level.*
——	*Temiskaming & Northern Ontario Ry.*
--------	*Porcupine Power Co. Transmission Line.*
– – –	*Wawaitin " " " "*

NOTES—(*Continued*)

carbonate, not unlike that in rock masses, occurs as veinstone in a few cases. For instance, the strong vein on the West Dome and adjacent claim is composed of a ferruginous carbonate that has been fractured and filled in with quartz; an analysis of this carbonate shows it to have the following composition: Ca O, 28.68%; Mg O, 14.20%; Fe O, 8.66%; C O$_2$, 43.14%. A somewhat similar carbonate occurs in a vein on the Hollinger Reserve in the township of Ogden and an analysis shows its composition to be: Ca O, 23.97%; Mg O, 9.46%; Fe O, 10.36%; C O$_2$, 34.94%.

LAURENTIAN.—About 10 miles to the southeast of Porcupine outcrops of hornblende granite are frequently seen. This granite intrudes the Keewatin. In a patch of conglomerate of the Cobalt series on the south line of Langmuir township, pebbles of hornblende granite occur, proving that some of the granites are pre-Cobalt series in age. A somewhat fine grained, biotite granite, occurring sparingly in the southern part of Whitney township, intrudes the Keewatin series, but its relation to the Temiskaming has not been determined.

Two series of pre-Cambrian sedimentary rocks occur which are later than the Keewatin:

(1) Temiskaming Series.—A series of sediments, which have been subjected to great metamorphism and are now highly inclined.

(2) Cobalt Series.—A series of sediments, which are little disturbed, corresponding to the Cobalt series in the Cobalt area.

(1) TEMISKAMING SERIES.—A belt of fragmental rocks that outcrops through the drift at irregular intervals has been traced from near the mouth of the Porcupine river, in the township of Cody, southwest across the northern part of Whitney and southwest through Tisdale to the Dome mine. In order to show the probable limits of this belt a tint has been used, whereas the outcrops are shown in full colour. Similar rock outcrops on the northeast bay of Night Hawk lake, and also southwest of Porcupine in the township of Bristol, and around Wawaitin falls. The Temiskaming series has been subjected to considerable metamorphism, often being altered to schists which are with difficulty distinguished from Keewatin schists. When dynamic metamorphism has taken place, one of the most difficult problems of the pre-Cambrian is to distinguish true fragmental, especially conglomerates, from volcanic fragmental material, or from friction breccias which are commonly called autoclastic rocks. In some areas doubtless each of these three classes (1) true conglomerates, (2) volcanic fragmental material, (3) friction breccias or autoclastic rocks, may be present. Then the pre-Cambrian geologist may be excused if he makes a mistake.

In parts of the area different facies of the series are well represented, showing a succession of conglomerate, impure quartzite or more massive greywacké, and slate or well-banded greywacké. Where the Temiskaming has been rendered schistose its recognition is assisted by the occurrence of these facies. It is difficult in some cases, as has been said above, to distinguish metamorphic conglomerate from volcanic fragmental or autoclastic rocks, but the more slate-like facies of the Temiskaming series tends to retain its original character more perfectly and is less apt to be mistaken for, or confused with, Keewatin rocks.

This series is distinguished from the Cobalt series not only by the steeply inclined position of the beds, but also by a marked secondary cleavage, often developed across the bedding planes, which is not seen in the later series. It is also marked by the presence of considerable carbonate.

(2) COBALT SERIES.—This series occurs only in small volume, being represented by a flat-lying conglomerate on the south boundary of Langmuir township in the southeastern corner of the area. The conglomerate contains numerous boulders of reddish granite and rests unconformably on a Keewatin floor.

Of these two series the Temiskaming only is of economic importance, the Cobalt series being of later age than the gold-bearing veins.

LATER INTRUSIVES.—Several dikes of olivine diabase and other basic rocks, cutting the Keewatin, have been found in the area. Some of these dikes are similar in character to the well-known dikes of Sudbury and to one or two that have been found in the Cobalt and Gowganda areas. The olivine diabase in the Porcupine area is considered to be younger than the Cobalt series.

GLACIAL AND RECENT DEPOSITS.—It is not necessary to say more concerning the glacial and recent deposits of the district than has been said in previous parts of these notes.

ORE BODIES

Outcrops of quartz are very numerous in the area mapped. They are found in rocks of both Keewatin and Temiskaming age. The age of the rock, whether Keewatin or Temiskaming, does not appear to have any bearing on the character of the vein, either as to form or as to gold content.

The writer has little doubt that the quartz deposits of the Porcupine area are connected with the great granite intrusions which took place in post-Temiskaming times. The quartz has been deposited from the impure waters, highly heated and under great pressure, which worked through the rocks after the granite intrusion. Some of the quartz veins give evidence of their genetic relation to granite intrusions; *e.g.* feldspar is seen in certain veins and the occurrence of tourmaline and gas bubbles in the quartz is corroborative evidence. Specimens having the composition of granite are to be found in a few veins which carry visible gold (Miller-Middleton).

There is a great variety of forms assumed by the quartz bodies. Sometimes they occur as well defined veins having great length as compared to width. As example of these may be taken the veins in the vicinity of Pearl lake. The No. 1 vein of the Hollinger group has been exposed for over 1,000 feet on the 100-foot level. By the term "vein" is not meant a solid body of quartz over this whole length. In parts of the ore body quartz fills the drift from wall to wall and occasionally is still broader, but in other parts there are numerous narrow stringers of quartz cutting the schistose rock. These broad quartz bodies and intersecting portions of narrow stringers and schist constitute the vein, and as a workable body are quite linear in character. Quartz masses having a width up to 100 feet are occasionally seen. These are portions of broad lenticular masses which are on their sides. The harder and more resistant quartz has withstood erosion better than the schist and now shows as dome-like masses. The best examples of domes occur at the Dome mine. Sometimes the ore body is very broad. At the Dome mine the ore body, consisting of quartz masses, narrow quartz veins and pyritous schist, has a width in one place of 250 feet.

A deposit distinct in character from these is the quartz ankerite vein on the West Dome. Here the mass of the vein is ankerite, while the quartz occurs as narrow veinlets mostly transverse to the vein. At one point the ankerite vein is 25 feet wide.

Where the rocks are not extremely schistose, as around Three Nations lake, the quartz veins, which are very narrow, have a regular character unlike the lenticular veins of the highly schistose areas. Similar narrow veins occur in the quartz-porphyry area south of the Dome.

The schistose rock along the veins is often impregnated with iron pyrites, and in most cases part of the walls will be mined and treated with the vein material. In general the larger lenticular veins of the area are approximately parallel to the strike of the enclosing schists, whereas the narrower, better defined veins generally show a strike quite different from the enclosing rock.

An examination of veins in the field and of thin sections of quartz under the microscope shows that the original quartz of the veins has been fractured and a great part of the gold deposited from solutions which circulated in the minute fissures and crushed areas of the quartz and enclosing rock. Crushed portions of veins are often indicated by dark streaks or patches in the quartz. Pyrite, calcite, sericite, chlorite, quartz and tourmaline frequently occur in the fractured areas. Often the later quartz has a bluish colour. These minerals are sometimes arranged in a parallel manner giving a banded character to the ore.

The following minerals occur in veins in different parts of the area:—Quartz, ankerite, calcite, sericite, chlorite, feldspar, tourmaline, scheelite, pyrite, pyrrhotite, copper pyrites, galena, zincblende, arsenopyrite and baryte.

Map Nº 21a

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